香港中文大學研究院教育學部

THE CHINESE UNIVERSITY OF HONG KONG
GRADUATE SCHOOL · DIVISION OF EDUCATION

文科教育碩士論文
Master of Arts in Education Thesis

論文題目
Thesis Title

A Study of the Norms of Hong Kong Students of Age Groups 15 to 18 in the Performance of Raven's Advanced Progressive Matrices Test

香港中五學生雷雲先進測驗常模之初探

撰作語言
Language Used
英文
English

研究生姓名
Name of Student
李念愉
LI Nim Yu

專修範圍
Specialization
課程設計與發展
Curriculum Planning and Development

論文考試委員會
Thesis Examination Committee

論文導師
Thesis Supervisor
鄭肇楨博士 Dr. Shiu-ching CHENG

校內委員
Internal Examiner
盧林發博士 Dr. Lam-fat LO

校內委員
Internal Examiner
蕭炳基博士 Dr. Ping-kee SIU

校外委員
External Examiner
Dr. G. Bradley SEAGER Jr.

學部主任
Division Head
杜祖貽教授 Prof. Cho-yee TO

論文通過日期
Date of Approval
August 22, 1986

A STUDY OF THE NORMS OF HONG KONG STUDENTS OF AGE GROUPS 15 to 18 IN THE PERFORMANCE OF RAVEN'S ADVANCED PROGRESSIVE MATRICES TEST

A Thesis Presented to
the School of Education
the Chinese University of Hong Kong
in Partial Fufillment of
the Requirements of the Degree of
Master of Arts in Education

by

LI Nim-yu, Kitty

under

the Supervision of

Dr S.C. CHENG

JUNE, 1986

ABSTRACT

Raven Junior, Court and Chan indicated that the APM has so far not been performed by students of the age groups 15 to 18. The belief that age groups 15 to 18 can adequately perform the APM which was originally designed for adults was confirmed by a pilot test conducted by the author. In this research, a sample of 1% of Hong Kong Form 4 and 1% of Form 5 students were drawn to do the test.

Results indicated that the mean score obtained in this test was 22.42 with a standard deviation of 5.84. The value of Cronbach Alpha was 0.87. Significant difference was found among the APM scores of subjects classified by sex, academic stream, parents' occupations and school types. However, there was no significant difference in the APM scores of groups classified by family size and regional divisions. These findings remained the same even when the number of APM items were reduced to 33 or even to 28.

One special phenomenon that this study revealed was that subjects of age group 15 scored the highest while the scores for the age groups 16, 17 and 18 were on a descending trend. To explain this unusual phenomenon factors such as repeater interference and item difficulties were tested but no causal relationships were found. Factors such as zeal in taking the test, number of students in private schools and possible under-representation of 18-year-old subjects were considered to be more acceptable explanations.

Considering education level and age as variables, item analysis of the APM test was performed. According to the groupings of age, sex, academic stream, parents' occupations, school types, regional divisions, family sizes and the repeater factor, comparisons of the original 36-item test with the modified 28-item and 33-item tests were performed. Implications and limitations were discussed for further improvement of the APM test.

CONTENTS

ACKNOWLEGEMENTS

The author wishes to thank Dr S.C. Cheng for his most helpful guidance, encouragement, support and invaluable comments in every stage of the thesis writing. She is also indebted to Dr P.K. Siu and Dr L.F. Lo for their valuable comments and suggestions on the proposal. Thanks are also due to Mr C.M. Chung who apart from giving comments on the proposal, also lent his kind assistance in programming writing on the part of Facility Value & Discrimination Indices.

Without the advice of the APM authorities Dr J.C. Raven , Dr J. Court who answered the author's questions promptly and the suggestions given by Dr J. Chan, this thesis could never have been carried out smoothly.

The author would like to express her indebtedness to Mr Hogan and Mr C.C. Choi of the Hong Kong Examinations Authority who helped to compute the total number of 1985 HKCEE students distributed in each type of school.

The author would also wish to take this opportunity to acknowledge Miss W.C. Wong, Mr K.H. To and Miss W.L. Wong for helping in data collection, Miss L.Y. Chiu for her efficient data entry and Mr Y.K. Lam for his advice on using the Music Script.

Last but not the least, thanks and appreciation are extended to the hard work and generous help from Mr James C.F. Wong in writing the computer programme for this thesis. Without the help from the aforesaid people, the due completion of this thesis would have been impossible.

LIST OF TABLES

CHAPTER I

INTRODUCTION

A. Background

In general, intelligence tests are rarely used in Hong Kong with the exception of the Standard Progressive Matrices test which is often used by the Educational Research Establishment of the Education Department. In fact, standardisation of the Standard Progressive Matrices test has been performed twice (1968-69 and 1981-83) by the Educational Research Establishment. In contrast, the Advanced Progressive Matrices test has hardly ever been used even though it is commonly considered to be a highly accurate instrument for testing the general intelligence of adults. This is explained by Chan (1984):

> "The Advanced Progressive Matrices has not been used in schools at all though occasionally employed by interest groups for screening purposes for superior adults. Hence the nature has not been fully understood in Hong Hong".

After scrutinizing the content of the Standard Progressive Matrices, I perceived that it was probably too easy for Form 4 and Form 5 students. This motivated me to conduct a pilot test using the Advanced Progressive Matrices with Form 5 students in a school in March, 1985. Most of the students obtained higher marks

than expected. In order to explore more deeply into the performance of students in age groups 15 to 18 on the test, I attempted to do a small scale study of the Advanced Progressive Matrices with students in these age groups.

B. The APM TEST

The Advanced Progressive Matrices test is regarded by most British Psychologists as the best instrument for measuring general intelligence, Spearman's g factor, via various forms of perceptual reasoning. The test assesses a person's ability to form comparison and reason by analogy. It is designed to test a person's capacity to apprehend meaningless figures presented for his observation, see the relations between them, conceive the nature of the figures completing each system of relations and by so doing develop a systematic method of reasoning.

Advanced Progressive Matrices Set I and II were originally designed in 1943 for use at War Office for the selection of officers. In 1947, a non-verbal revision was prepared for general use in testing intellectual efficiency. In 1962, a revised edition was arranged and 12 problems which had made little contribution to the score distribution of adults with higher intellectual ability were taken out.

In this research, the APM test used is the 1962 edition. It can be applied to subjects of above average

intellectual ability. Set I which contains 12 problems is used as a practice test for Set II or as a rough screening test. Set II which contains 36 problems is used as a 'test of intellectual efficiency' when used with a time limit (usually 40 minutes). In presentation and argument, the two sets are identical. Their only difference lies in the gradual increase in difficulty and complexity in Set II.

Advantages of using the APM

With respect to administration, the equipment is simple - only two booklets and a scoring sheet are needed. Administration and scoring are easy.

Compared with a verbal test, the APM can assess the clarity of a person's thought processes independent of his educational attainment.

As a performance test, it has the advantage that for the amount of time spent in giving the test, the information obtained is more reliable and valuable than that derived from other tests.

Finally, compared with other IQ tests such as Binet's, Weschler's and Gesell's, Raven's APM is a good instrument for it does not involve language barrier and is a culture-free test.

C. Purpose of the study

The present study attempts to explore three elements of the nature of the APM when used with students in age groups 15 to 18. Firstly, the norms of students in these age groups will be established. Secondly, the relationships between APM scores and sex, age, academic stream, socio-economic status and family size will be investigated. Lastly, analysis of the APM in terms of its facility value, discrimination indices will be performed.

D. Significance and contribution

It is hoped to find a suitable instrument for measuring the general intelligence of students in age groups 15 to 18 so that educationalists can apply the instrument in research. This research may be a pioneer of its kind in Hong Kong; more attention is expected to be drawn from the educational field so that with the establishment of APM norms, the instrument would not be confined to educational use but may also be extended to clinical and vocational uses.

Though the Education Department has twice performed standardisation on the Standard Progressive Matrices, the relationships between IQ and other factors such as family size, sex, age, parent's occupation have not been deeply explored. It is therefore hoped that this study can reveal some of the relationships between APM scores and other factors which might be of interest not only to

educationalists, but also to social workers and policy makers.

The data collected in this study may serve as a valuable reference for future work in standardisation of the APM for subjects of age groups 15 to 18 in Hong Kong. It is also hoped that the data collected in this study can provide information for comparison between the performance of university students and the 15- to 18-year-old groups in Hong Kong and other countries.

CHAPTER II

LITERATURE REVIEW

The survey of literature of APM research was based on three sources. First, it was the Bibliography of APM Manual 1975.[1] Second, it was Court's Researchers Bibliography of APM 1982 and some other articles compiled up to 1984. Third, it was Raven's typescript of the new version of APM which was to be published in 1985. The period these three sources covered was from 1950 to 1985.

Articles published in the period 1950 to 1966 could be found in the bibliography list of APM manual 1975. Principal researchers were Foulds, Raven, Yates and Venables. Foulds and Raven (1950) found that the reliability of the APM was low when it was applied to subjects below the age of 11. The scale's re-test reliability coefficient increased rapidly for subjects above the age of 11.

Venables (1960, 1961) explored the effects of the APM in the selection of engineering apprentices. His research which was started in 1950 was a longitudinal study. It traced the changes of a group of part-time engineering students in terms of the development of their intelligence during their first and third year of studies. In this study, a group of part-time day

release engineering students in 3 local technical colleges were given a verbal and an APM test early in their first year, and half way through their third year. Significant gains were found on the verbal test at all levels of initial score. Students who had no failures in the previous two examinations showed greater gains than those who had failed at least once. It was suggested that records be scrutinized for such patterns and additional time for taking the APM test be allowed where necessary.

Yates (1966) used the newly printed APM 1962 version (36 items in Book 2 instead of 48) to do a standardization study of first year students from the University of Western Australia. His findings indicated that the difficulties inherent in the use of the Advanced Progressive Matrices had not been overcome by shortening the test from 48 to 36 items. He concluded that the new version of the Advanced Progressive Matrices was still an unknown combination of power and speed factors. In view of the demonstration that a significant proportion of subjects obtained lower power score in limited (40 mins) than in unlimited time, Yates (1963) suggested that the new version of the test should be used with this caution in mind.

In addition, Yates(1966) administered the 1947 APM version and an Arithmetic Test with initial and final time limits to a group of 100 9-yr-old pupils. It was shown that, as in previous studies with university students, groups of subjects could be identified who were slow but accurate workers whose intellectual level was severely underestimated when time limits were imposed on them. It was also shown that the same subjects tended to be handicapped when time limits were imposed on both tests. No relationship between preferred work method and neuroticism or extraversion scores on the junior Maudsley Personality Inventory was found.

In the 1975 APM Manual, Raven did not include any normative data of age groups 15 to 18 (Raven 1975,p.24) and the estimated percentile points only covered the age groups from 11.5 to 14 and 20 to 40, leaving a gap of age groups 15 to 19.

Thus the major research on the APM from 1950 to 1966 did not touch upon age groups 15 to 18 which was the target population of this research. Articles reviewed in this period only provided background information on how APM was improved in terms of its content, (1947 edition and 1962 edition), how time limits affected the subjects' performance, and how the APM was used to find out the changes and personality factors in different age groups.

One point which was obvious in past research was that the target subjects of the APM were usually adults or university students. Such a fact can be supported by Yates (1961, 62, 63, 66).

According to literature, the target of APM research from 1966 to 1984 still focused on adults. Three major areas could be identified; they were educational, vocational and clinical.

(1) Educational use - Poole & Stanley (1972) examined the validity of the APM as one in a battery of instruments for predicting success in university engineering studies. It was found to have a loading of 0.63 on a factor identified as figure manipulation or visualisation. McLaurin et al (1973) compared APM performance by college students with other intellectual measures including WAIS, OTIS, D48, Revised Beta and Minnesota PFB. a group of 131 college students were given these tests in order to determine the inter-correlation between non-verbal and verbal intelligence tests. The results showed that correlation between the APM and the WAIS was 0.74 while with the Otis IQ, the correlation was 0.75.

In Dillon's research (1980), a group of 96 college students of equivalent ability were assessed for performance on the APM under two elaborative testing conditions. They were given 12 items with examinee verbalization on strategies and 12 items using elaborated feedback from the examiner. The results showed that students who performed better under either

condition demonstrated superior analogical reasoning performance to students who had displayed no condition preference.

The APM was also applied to testing the effects of semantic and non-semantic contexts on the solution of complex problems. In an experiment by Hesse (1982), an independent group (N=120) had to solve formally with or without semantic contexts identical complex problems which were normally embedded in a semantic context. Students under the semantic condition performed better by asking the examiner questions while students under the non-semantic condition made use of highly structured notes - a kind of external memory. The results showed that no correlation was found between APM scores and performance on semantic problems, but a significant correlation emerged with performance under the non-semantic condition (r= 0.146).

Apart from the above, the APM has been used for prediction of academic success of first year university students (Van Dam, 1982). The result showed that higher APM scores could predict students' success and that successful students differed somewhat when choices of APM items were analyzed.

(2) Clinical use - the APM test has been widely used on testing the effects of alcohol on human beings. Jones (1974) employed 40 paid volunteers to do this test. Compared with a placebo group, significant impairment on APM performance was found with the alcoholic group in the afternoon, and the alcoholic group did more poorly in the afternoon than in the evening.

Drug preference and response to marijuana and alcohol was also tested by using the APM. Linton (1976) did an experiment which analysed the effects of drug preference on selected cognitive, perceptual and physiological measurements while students were under the influence of either marijuana or alcohol. The APM was presented in three sets of 16 items in slide format. The results showed that the APM scores were not different between the two groups, but did change significantly under the influence of drugs.

Research has also been done on the recovery of alcoholics from cerebral impairment after abstinence. Kish (1980) did a study of the time course of recovery from cerebral impairment associated with heavy drinking. Four groups of male alcoholics were tested after 6, 15, 21, and 110 days of abstinence with four tests. They were Trail Making Test, Memory for Designs, WAIS subtests and the APM (Set I). Results showed that significant improvement occurred during the third week following abstinence.

Furthermore, the APM has also been applied in

discovering the relationship between intelligence and spontaneous flexibility in adulthood and old age. Schultz (1980) found that there was a significant age effect on both intelligence and flexibility. Re-test reliability for the APM Set I was 0.5 for the younger group and 0.69 for the older group.

The differential improvement of cognitive functions in recovering alcoholic women was explored by means of the APM. Fabian (1983) investigated the long-term recovery of cognitive functioning in alcoholic women by using an independent groups design and a test-retest analysis. In the independent groups design, long-term sober alcoholics(n=40) performed at or near the short-term sober alcoholic (n= 40) level on several perceptuomotor speed tasks. When the long-term sober alcoholics were compared with the non-alcoholic group (N=70) using several complex problem-solving measures, it was found that both groups obtained average scores with most measures suggesting a differential improvement in cognitive abilities. However, when the alcoholics were compared with the non-alcoholic group, it was found that they performed less well in both tests, i.e. abstract visual-spatial and perceptuomotor measures, although they did show a trend toward greater improvement in these tests in the follow-up. The results also suggested that post-treatment drinking might be a variable of considerable importance to the recovery of cognitive functions in alcoholics.

Clinically, the APM had a variety of applications but the chief one was for testing alcoholic effects on human intelligence.

(3) Vocational Use - It could be traced back to as early as 1943 when the APM was used to select officers for the War Office. Dillon (1981) invited 11 male Navy recruits to complete 12 APM items projected on a screen so that the predictive validity of a series of eye scan indices could be determined with respect to a technical school qualifying test. By using an oculometer, it was possible to record and analyse fixations and scanning strategies, relating these both to APM performance and to level achieved on part of the Armed Services Vocational Battery.

Horn (1982) collected data from 300 candidates for officer posts. The report showed that their mean APM scores had a negative correlation of about 0.2 with teacher assessments. A comparison between results of verbal academic attainment tests and APM scores indicated a positive correlation of around 0.3. When APM scores were compared with mathematics attainments and results of mechanical comprehension tests, the correlation was found to be 0.5 and 0.47 respectively. According to Raven in 1985, these data suggested that teachers had underestimated the attainments of able children, perhaps with a view to 'motivating' them.

In response to my enquiry for the most recent data of the performance of the age groups 15 to 18 in the APM, Raven[2] indicated that he was at a disadvantage for he knew little about the norms of these age groups. However, he sent me the typescript of a revised section of the new APM Manual which was to be published. The new APM Manual does not include any data of the estimated percentile points for the age groups 15 to 18. Nevertheless, the typescript does indicate that the APM is not only used to test adults but also employed for selecting gifted and talented 6th grade children (11 years old) in North America in 1984. Horn's (1979) APM standardisation of 15-year-old German students from four types of secondary school was included. Such data were to a certain extent relevant to my present study. In the 15-year-old German sample, 1,015 school children from Bavarian secondary schools, secondary modern schools, grammar schools, vocational schools, and comprehensive schools were taken. The mean of the APM test was 19.04 and the standard deviation was 6.56. The reliability was found to be 0.87 (Cronbach alpha).

The 1962 APM version was administered to 996 students of age 15 and 16 in Baden-Wurttenberg, Hessen & Rheinland-pfalz. The results are shown in Table 1.

Table 1

APM performance of age groups 15 and 16 in 4 types of German school

	Secondary Technical			Secondary Modern			Grammar			Comprehensive		
age	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD
15	147	26.1	5.8	166	32.2	5.1	87	33.9	5.9	79	30.1	5.9
16	54	26.4	7.8	126	31.4	6.2	43	32.9	5.5	64	31.3	6.3

Based on the results of the 1015 Bavarian 15-year-olds and the 996 students, the mean APM score was found to be 29.4 and the standard deviation was 7.8.

Though the APM Manual in print showed that the test's application had been diversified from 11-year to 16-year olds and even to adults, no data were added for the 15- to 18-year-old groups.

In reply to my letter in 1985, Court also indicated that the APM was not widely used in Australian secondary schools but was commonly employed at the tertiary level.

Chan (1985) of the Educational Research Establishment has also confirmed that so far no research data is available for the age groups 15 to 18 on APM performance in Hong Kong.

A survey of the literature revealed a vacuum that so far no data on the APM performance by 15- to 18-year-old students were available for study, Thus, it was perceived that there might be a strong need to investigate the performance of 15- to 18-year old students in the APM test, and the present research might be considered as a pioneer study of APM performance by these age groups.

CHAPTER III

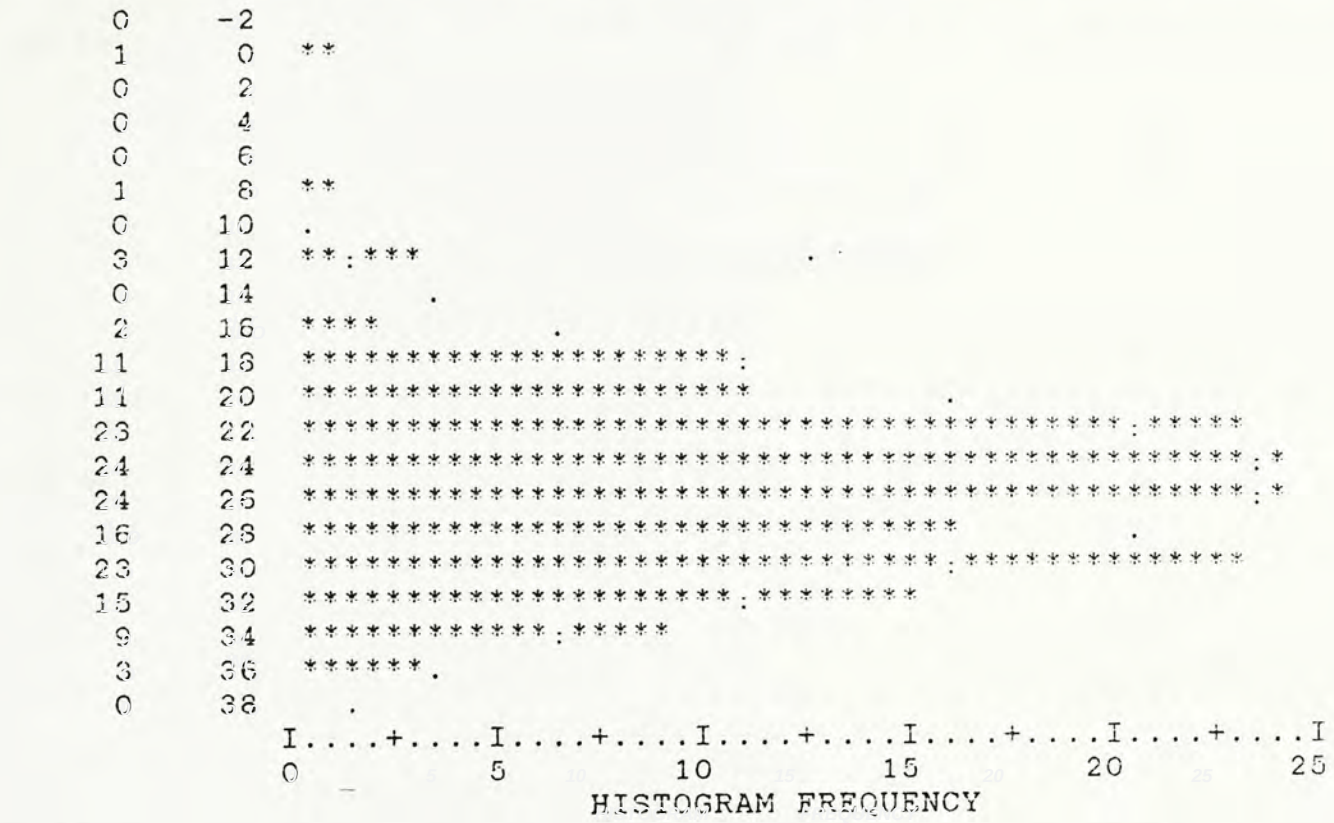
PILOT STUDY

AS the 12 problems of APM Set I include all the intellectual processes covered by the Standard Progressive Matrices Sets A, B, C, D, E, the APM was therefore employed to test the intelligence of 163 aided school students who were of Hong Kong Certificate of Education Examination (HKCEE) level in March, 1985. An aided school was chosen because this type of school is most representative since the majority of secondary schools in Hong Kong fall into this category (64.6%).

The findings showed that the mean APM score was 25.00 (maximum score is 36) with a standard deviation of 5.58. The reliability was found to be 0.82 (K.R.20). When the scores were plotted on the graph, the curve appeared to be slightly skew resembling a bell shape. (See Table 2)

Table 2

APM scores distribution in the pilot test



MEAN	25.006	STD ERR	.434	MEDIAN	25.000
MODE	24.000	STD DEV	5.568	VARIANCE	31.230
KURTOSIS	1.939	S E KURT	.375	SKEWNESS	-.774
S E SKEW	.188	RANGE	36.000	MINIMUM	.000
MAXIMUM	36.000	SUM	4151.000		
VALID CASES	166	MISSING CASES	0		

The pilot study also covered relationships between APM scores and age, sex, academic stream and family size. Considering age as a variable, there existed no significant difference in APM scores among age groups 16 to 19.

Table 3

APM scores for age groups 16 to 19 in the pilot test

AGE GROUP	N	$\bar{X}$	SD
16	36	24.72	5.86
17	80	25.70	5.57
18	37	24.35	5.77
19	10	23.30	4.11
TOTAL	163	25.03	5.57

When the sex variable was considered, it was found that male students scored higher than female students ($t(164)=3.86$ $p<.05$). With regard to academic stream, science students on the whole scored better than Arts students ($t(164)=5.55$ $p<.05$), but when the data were further broken down, no significant difference was discovered between the scores of Arts boys and the scores of Science girls.

In considering the variable of family size, no significant difference was found between the scores of subjects from big families (families with more than 2 children) and the scores of subjects from small families (families with 2 children or less).

The Pearson correlation coefficient between APM scores and results of mock examination was high ($r=0.28$ at .001 level).

Table 4

Correlation between APM scores and Mock examination results in the pilot test

Pearson Correlation Coefficients		
	IQ	EXAM.
IQ	1.0000	0.2811**
EXAM	0.2811**	1.0000

** - Significant level at 0.001

Based on these data, it was believed that the APM could be applied in testing the general intelligence of students in age groups 15 to 18.

CHAPTER IV

METHOD OF STUDY

In order to find out whether there was any significant difference in score between groups differentiated by age, sex, academic stream, family size, parent's occupation, type of school and regional division, seven hypotheses were constructed.

A. Hypotheses

Hypothesis 1

There is no significant difference among the APM scores of different age groups.

Hypothesis 2

There is no significant difference between the APM scores of male students and the APM scores of female students.

Hypothesis 3

There is no significant difference between the APM scores of Science students and the APM scores of Arts students.

Hypothesis 4

There is no significant difference between the APM scores of subjects from families with more than two children and the APM scores of subjects from families with 2 children or less.

Hypothesis 5

There is no significant difference among the APM scores of students grouped according to their parents' occupations.

Hypothesis 6

There is no significant difference among the APM scores of subjects from different types of school(i.e. government, aided & private schools)

Hypothesis 7

There is no significant difference among the APM scores of subjects from schools in different regions (i.e. Kowloon, the New Territories & Hong Kong Island).

B Instrument

The Advanced Progressive Matrices test was used. There are two booklets which contain two parts of the test. Set I is a practice test. Set II is used for assessing the students' general intelligence. The problems in Set II are identical with those in Set I in presentation and argument. The only difference lies in the gradual increase in difficulty and complexity in Set II. An answer sheet including personal details was provided (Appendix 1). The personal details covered the subject's name, date of birth, sex, academic stream, total number of brothers and sisters and parent's occupation. The small boxes on the right hand column were used for entry coding. The school and the student's codes were to be assigned and entered before the answer sheet was given.

C. Sampling

(1) Subjects - The selection of subjects aged 15 to 18 was done on a random territory-wide basis. From taking 2% of the total number of HKCEE students (74,594) in 1985, 1500 subjects were drawn as the target sample size. Of the 2 % of the total number of subjects, 1% went to Form 5 while the other 1% would go to Form 4. Since the number of Form 4 students were more than those in Form 5, altogether 809 Form 4 students and 686 Form 5 students were chosen from 23 schools.

(2) Method - The method employed was a 5-stage proportionate stratified sampling.

Stage 1 - Total number of schools participating in the 1985 HKCEE.

A list of schools participating in the 1985 HKCEE was collected from the Hong Kong Examinations Authority. Schools typed under Government, Aided, and Private were also classified according to their regional divisions, i.e. whether they were in Hong Kong, Kowloon or the New Territories. By using a Latin Square, two axes were constructed with the vertical one as types of school and the horizontal axis as regional divisions. Altogether there were 9 cells.(Appendix 2)

Stage 2 - Total number of HKCEE students in

1985.

By adding the number of students in each cell, it was found that the total number of students who sat in the 1985 HKCEE was 74,594.

Stage 3 - Total number of subjects required.

As the required percentage of the sample population was 2, the total number of subjects to be drawn was approximately 1,500. Number of subjects required in each cell was proportionally taken according to the target sample size. (Appendix 2)

Stage 4 - Total number of classes required.

To obtain an even number of Science and Arts subjects, the number of students in each cell was divided by two. Thus, the required number of Arts and Science students in each cell could be obtained. By assuming that a normal F.5 class consists of 40 students, the number of classes in each cell was computed. Although 46 classes participated in the APM test, only the stipulated number of subjects were chosen.

Stage 5 - Total number of schools required.

Two classes, one of Science and one of Arts, in each school were required. The number of sampled schools was calculated according to the number of classes stipulated in Stage 4. With a total number of 46 classes, 23 schools in all 3 regions were chosen. A composition of sampled schools is attached in Appendix 2. The following table summarizes the 5-stage proportionate sampling.

Table 5

Summary of 5-stage proportionate sampling

Stage		
1	Total number of schools participating in the 1985 HKCEE.	(401)
2	Total number of HKCEE students in 1985 in all types of school.	(74,594)
3	Total number of subjects drawn in all types of school.	(1,497)
4	Total number of classes required with equal distribution of Science & Arts classes.	(46)
5	Total number of schools drawn in all 3 regional divisions.	(23)

Replacement

Schools would be drawn at random again for replacement in case a request for co-operation in performing the test was declined.

D. Procedure

The instruction given to students was in accordance with the Manual of the APM 1975 except that it was conveyed in Cantonese. Each class had to sit for one hour which included the time for giving instruction and distribution of the question papers (see Appendix 3). The time limit for completing the test was 40 minutes.

E. Data Analysis

F and t tests were used for analysis in hypotheses 1, 5, 6, 7, and 2, 3, 4 respectively. For item analysis, median separation and bi-serial correlation were used for finding out the discrimination indices.

CHAPTER V

RESULTS OF STUDY

A. Distribution of scores

The mean score of the APM test was 22.42 and the standard deviation was 5.84. Such results were close to those of New Zealand tertiary students,1968 (age means 20.43) (See Appendix 5) whose mean score was 22.55 and whose standard deviation was 4.49. However, compared with the 15-year-old German sample whose mean and standard deviation were 19.04 and 6.56 respectively, the 15-year-old group in this study scored higher than German counterparts with mean equals to 23.10 and standard deviation equals to 5.34.

The Percentile norms of APM scores for age groups 15 to 18 is tabulated in Table 6. The norm table is established for age groups 15 to 18 containing the percentile ranks at a 5% interval from 5 to 95.

The 50th percentile (the median) matches closely with the mean APM score of age groups 16 to 18 except age group 15 in which the percentile score is slightly smaller than the mean APM score. Judging from this data, it is noted that the corresponding scores of the 50th percentiles of age groups 15 to 18 approximates the APM mean scores of each age group. Hence, the 50th percentile can be regarded as indicating the average performance of subjects in each age group, while

percentiles below the 50th might suggest that subjects showed a below average APM performance.

When the norm of age groups 15 to 18 is analyzed by sex,(see Table 7) the 50th percentile that cuts across the 4 age groups indicates that males have a higher percentile than females. Moreover the corresponding APM scores of the 50 percentiles between males and females approximates the mean APM scores in each age group.

Even though the 176 repeaters of the whole sample were taken out, the trend of the norms remained unchanged. (See Table 8,9)

Table 6

Norm of APM scores for age groups 15 to 18

PERCENTILE	AGE: 15	AGE: 16	AGE: 17	AGE: 18
95.00	32.00	31.40	31.00	30.00
90.00	30.00	30.00	29.00	29.00
85.00	28.70	29.00	28.00	28.00
80.00	27.00	28.00	27.00	27.00
75.00	27.00	27.00	26.50	26.00
70.00	26.00	26.00	26.00	25.00
65.00	25.00	25.00	25.00	24.00
60.00	25.00	24.20	24.00	24.00
55.00	24.00	24.00	23.00	23.00
50.00	23.00	23.00	23.00	22.00
45.00	23.00	22.00	22.00	21.65
40.00	22.00	22.00	21.00	21.00
35.00	21.00	21.00	20.00	20.00
30.00	20.00	20.00	19.00	18.10
25.00	20.00	19.00	19.00	17.00
20.00	19.00	18.00	17.00	16.00
15.00	18.00	17.00	16.00	14.00
10.00	16.00	15.00	14.00	12.70
5.00	14.00	12.00	10.50	8.00
MEAN	23.15	22.63	22.13	21.18
STD DEV	5.35	5.89	5.82	6.36
VALID CASES	341	551	409	196

Table 7

Norm of APM scores for age groups 15 to 18 by sex

	AGE: 15		AGE: 16		AGE: 17		AGE: 18	
PERCENTILE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
95.00	33.05	30.00	32.00	31.00	31.00	30.00	31.00	28.10
90.00	31.10	28.60	31.00	29.00	30.00	28.00	29.00	26.20
85.00	30.00	27.00	29.00	27.60	28.00	27.00	29.00	25.00
80.00	28.20	26.00	28.00	26.00	27.00	26.00	28.00	24.00
75.00	28.00	26.00	27.75	25.00	27.00	25.00	27.00	23.50
70.00	27.00	25.00	27.00	25.00	26.00	25.00	26.00	23.00
65.00	26.00	24.00	26.00	24.00	25.00	24.00	25.00	23.00
60.00	26.00	24.00	25.00	23.00	25.00	23.00	25.00	22.00
55.00	25.00	23.00	25.00	23.00	24.00	23.00	24.00	21.90
50.00	24.00	22.00	24.00	22.00	23.00	22.00	23.00	20.00
45.00	24.00	22.00	23.00	21.00	22.00	21.00	22.00	20.00
40.00	23.00	21.00	23.00	20.00	22.00	20.00	21.00	18.20
35.00	22.65	20.00	22.00	20.00	21.00	20.00	21.00	18.00
30.00	21.70	20.00	21.00	19.00	20.00	19.00	20.00	17.00
25.00	20.00	19.00	20.00	18.00	19.00	18.00	18.00	15.00
20.00	20.00	17.00	19.40	17.00	17.20	17.00	17.00	14.00
15.00	19.00	16.00	18.00	15.00	16.00	16.00	15.00	13.00
10.00	18.00	16.00	16.00	14.00	14.00	14.00	13.00	10.80
5.00	15.00	14.00	13.00	11.00	10.00	11.00	8.00	8.00
MEAN	24.20	22.00	23.52	21.43	22.45	21.52	21.88	19.49
STD DEV	5.48	4.97	5.79	5.82	5.98	5.45	6.54	5.61
VALID CASES	178	163	316	235	270	139	139	57

Table 8

Norm of APM scores for age groups 15 to 18

non-repeaters

PERCENTILE	AGE: 15	AGE: 16	AGE: 17	AGE: 18
95.00	32.00	31.00	31.00	29.00
90.00	30.00	30.00	29.00	29.00
85.00	28.85	28.30	28.00	27.00
80.00	27.00	27.40	27.00	26.00
75.00	27.00	27.00	26.00	25.75
70.00	26.00	26.00	25.00	25.00
65.00	25.00	25.00	25.00	24.00
60.00	25.00	24.00	24.00	23.00
55.00	24.00	24.00	23.00	22.55
50.00	23.50	23.00	23.00	22.00
45.00	23.00	22.00	22.00	21.00
40.00	22.00	22.00	21.00	20.00
35.00	21.00	21.00	20.00	19.00
30.00	20.00	20.00	19.00	18.00
25.00	20.00	19.00	18.00	17.00
20.00	19.00	18.00	17.00	15.00
15.00	18.00	17.00	16.00	14.00
10.00	16.00	15.00	13.00	11.20
5.00	14.00	12.00	10.00	8.00
MEAN	23.15	22.52	21.94	20.66
STD DEV	5.36	5.89	5.96	6.41
VALID CASES	340	517	324	140

Table 9

Norm of APM scores for age groups 15 to 18

non-repeaters by sex

	AGE: 15		AGE: 16		AGE: 17		AGE: 18	
PERCENTILE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE
95.00	33.10	30.00	32.00	30.85	31.00	29.95	30.00	28.00
90.00	31.20	28.60	30.00	29.00	30.00	28.00	29.00	26.00
85.00	30.00	27.00	29.00	27.00	28.00	26.85	28.00	25.00
80.00	28.40	26.00	28.00	26.00	27.00	26.00	27.00	24.00
75.00	28.00	26.00	27.00	25.00	27.00	24.75	26.00	23.00
70.00	27.00	25.00	27.00	25.00	26.00	24.00	25.00	23.00
65.00	26.00	24.00	26.00	24.00	25.00	23.00	25.00	23.00
60.00	26.00	24.00	25.00	23.00	25.00	23.00	24.00	20.00
55.00	25.00	23.00	25.00	22.00	24.00	22.00	23.10	20.00
50.00	24.00	22.00	24.00	21.00	23.00	22.00	22.00	19.00
45.00	24.00	22.00	23.00	21.00	22.00	21.45	21.90	18.00
40.00	23.00	21.00	23.00	20.00	21.00	20.00	21.00	18.00
35.00	22.30	20.00	22.00	19.05	21.00	19.35	20.00	17.00
30.00	21.40	20.00	21.00	18.90	20.00	19.00	18.60	14.00
25.00	20.00	19.00	20.00	17.00	19.00	18.00	17.50	14.00
20.00	20.00	17.00	20.00	16.60	17.00	17.00	16.00	13.00
15.00	19.00	16.00	18.00	15.00	16.00	16.00	15.00	13.00
10.00	18.00	16.00	16.00	14.00	13.00	13.10	13.00	9.00
5.00	15.00	14.00	13.00	11.00	10.00	11.05	7.10	8.00
MEAN	24.20	22.00	23.50	21.22	22.26	21.21	21.41	18.72
STD DEV	5.50	4.97	5.77	5.80	6.14	5.47	6.45	5.96
VALID CASES	177	163	295	222	224	100	101	39

Table 10 shows the distribution of scores for age groups 15 to 18. The distribution of scores was normal with most subjects scoring 23 out of 36.

Table 10

Distribution of APM scores

```
COUNT   MIDPOINT    ONE SYMBOL EQUALS APPROXIMATELY
                        3.00 OCCURRENCES

  0        -2
  0         0
  1         2
  7         4   *
 11         6   :
 14         8   :*
 25        10   **:
 27        12   *** .
 59        14   ******* .
 80        16   **********    .
116        18   ***************    .
171        20   ************************ .
190        22   ***************************.
213        24   ***************************:**
206        26   ***********************:*****
165        28   ***************:*****
114        30   **********:***
 62        32   ******:*
 28        34   ***:
  6        36   *.
  0        38   .
              I....+....I....+....I....+....I....+....I
              0        80       160      240      320
                   HISTOGRAM FREQUENCY
```

Table 11 shows the marks distribution of APM performance for age groups 15 to 18.

Table 11

Distribution of marks

VALUE	FREQUENCY	PERCENT	CUM PERCENT
1.00	1	.1	.1
3.00	4	.3	.3
4.00	3	.2	.5
5.00	4	.3	.8
6.00	7	.5	1.3
7.00	6	.4	1.7
8.00	8	.5	2.2
9.00	7	.5	2.7
10.00	18	1.2	3.9
11.00	10	.7	4.5
12.00	17	1.1	5.7
13.00	27	1.8	7.5
14.00	32	2.1	9.6
15.00	30	2.0	11.6
16.00	50	3.3	15.0
17.00	55	3.7	18.6
18.00	61	4.1	22.7
19.00	73	4.9	27.6
20.00	98	6.5	34.1
21.00	83	5.5	39.7
22.00	107	7.1	46.8
23.00	115	7.7	54.5
24.00	98	6.5	61.1
25.00	113	7.5	68.6
26.00	93	6.2	74.8
27.00	94	6.3	81.1
28.00	71	4.7	85.8
29.00	63	4.2	90.0
30.00	51	3.4	93.5
31.00	39	2.6	96.1
32.00	23	1.5	97.6
33.00	13	.9	98.5
34.00	15	1.0	99.5
35.00	5	.3	99.8
36.00	3	.2	100.0
TOTAL	1497	100.0	

B. Reliability of the instrument

The reliability coefficient for this study was found to be 0.84 (K.R. 20) which was close to that of the 15-year-old German Standardisation sample whose Cronbach Alpha value was 0.87. By using Split Half to test the internal consistency of the APM items, the alpha value for the 18 items in Part 1 was found to be 0.76 while for the 18 items in Part 2 it was 0..73. The value of Split Half (Equal Length Spearman Brown) was 0.77. Lapsley & Enright (1979) used the APM test on groups of Southern States University students, and found the value of Split Half 0.75 which was very near to what has been found in this research.

Comparing the values of Split Half between the 15-year-old Hong Kong sample and the 15-year-old German sample, it was found that the value of Split Half of the Hong Kong sample was 0.68 while their German counterpart's was 0.87. Values of Cronbach Alpha for the Hong Kong sample and the German sample were 0.87 and 0.84 respectively.

Both the values of Split Half and K.R.20 in the Hong Kong 15-year-old sample were close to the German ones. It could be said that the APM as an instrument for testing of intelligence of the 15-year-old age group is reliable.

C. Findings

Hypothesis 1

It was assumed that there was no significant difference among the APM scores of age groups 15 to 18. The findings indicated that this hypothesis did not hold. Results showed that the score descended with age, with the 15-year-old group scoring the highest. Such a phenomenon was unexpected for past research with other age groups had shown that the score increased with age. Table 12 shows the trend of APM scores in relation to age.

Table 12

Mean APM scores of age groups 15 to 18

Age	N	$\bar{X}$	SD
15	341	23.14	5.34
16	551	22.62	5.88
17	409	22.13	5.81
18	196	21.18	6.36
Total	1497	22.42	5.84

The result of the Scheffe Test indicated that the age groups of 15 and 16 scored significantly higher than the age groups of 17 and 18.

Table 13

Test of age group difference in APM scores

Age groups	18	17	16	15
18				
17				
16	*			
15	*			

* - significantly different at 0.05 level

In order to explain such a special phenomenon that younger subjects should have scored higher than older subjects, five possible reasons were suggested.

(1) Zeal in taking the test

To quote Thorndike's phrase(1924), zeal in taking the test has to be considered whenever tests are performed. It was difficult to measure how zealous or serious the subjects were when they were taking the APM test. Many a time, it is found that younger subjects tend to do tests with greater enthusiasm when compared with older subjects. Perhaps they feel more curious, thus they will do the test more seriously. That might account for the fact that the 15-year-old group scored the highest among the 15- to 18-year-old groups. Such possibility does exist but it is hard to prove as no one can read the subject's degree of zeal in performing the test.

(2) Repeaters

Form 4 and Form 5 repeaters in Hong Kong are common. It is possible that the great number of repeaters in higher forms may have pulled down the mean score of each of the 16- to 18-year old groups. However, the fact that age group 15 scored the highest remained unchanged even though the 176 repeaters were taken out from the sample. (See Table 14)

Table 14

Mean APM scores of age groups 15 to 18 non-repeaters

Age	N	$\bar{X}$	SD
15	340	23.15	5.36
16	517	22.52	5.89
17	324	21.94	5.96
18	140	20.66	6.41
Total	1321	22.34	5.87

From sorting out the number of repeaters in Form 4 and Form 5 in Government, Aided, and Private schools, it was found that the total percentage of repeaters was 11.75. Table 15 shows the age distribution of Form 4 and Form 5 repeaters and non-repeaters.

Table 15

Number of repeaters & non-repeaters for age groups 15 to 18 in F.4 & F.5

		Age groups											
		15			16			17			18		
F	N	R	NR	T	R	NR	T	R	NR	T	R	NR	T
5	688	0	14	14	3	273	276	60	189	309	53	96	149
4	809	1	326	327	31	244	275	25	135	160	3	44	47
T	1497	1	340	341	34	517	551	85	324	469	56	140	196

R - Repeater NR - Non-repeater

T - Total F - Form

With regard to the number of repeaters distributed in government, aided, private schools, it was found that 61.6% of the Form 4 repeaters studied in aided schools while 56.1% of the Form 5 repeaters studied in private schools. Distribution of Form 4 and of Form 5 repeaters in three types of school were shown in Tables 16 and 17 respectively.

Table 16

Distribution of F.4 repeaters in

Government, Aided & Private Schools

School type	Regional division: Hong Kong	Kowloon	New Territories	Total
Gov't	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
Aided	3.3% (2)	36.7% (22)	21.7% (13)	61.7% (37)
Private	30.0% (18)	6.7% (4)	1.6% (1)	38.3% (23)
Total	33.3% (20)	43.3% (26)	23.4% (14)	100.0% (60)

( ) - number of repeaters

Table 17

Distribution of F.5 repeaters in

Government, Aided, & Private Schools

School type	Regional division: Hong Kong	Kowloon	New Territories	Total
Gov't	0.0% (0)	0.9% (1)	0.0% (0)	0.9% (1)
Aided	9.4% (11)	15.5% (18)	18.1% (21)	43.0% (50)
Private	19.1% (22)	37.0% (43)	0.0% (0)	56.1% (65)
Total	28.5% (33)	53.4% (62)	18.1% (21)	100.0%(116)

( ) - number of repeaters

Overall results of repeaters and non-repeaters

In comparing the scores of the total number of repeaters and the scores of the total number of non-repeaters, no significant difference was found (Table 18).

Table 18

Comparison of APM scores between repeaters and non-repeaters

	N	$\bar{X}$	SD	t-VALUE	df	2 TAIL-PROB.
R	176	23.02	5.61			
				1.45	1495	0.16
N	1321	22.34	5.86			

R - Repeater NR - Non-repeater

$p > 0.05$

Age groups 15 to 18

Since there was only one 15-year-old repeater, the means between non-repeater and repeater could not be compared. By comparing the means of non-repeaters and the means of repeaters in age groups 16 to 18, no significant difference was found.

Table 19

Comparisons of APM scores between repeaters & non-repeaters in age groups 16 to 18

Age	R	$\bar{X}$	SD	NR	$\bar{X}$	SD
16	34	24.23	5.77	517	22.52	5.88
17	85	22.88	5.21	324	21.93	5.95
18	56	22.50	6.09	140	20.65	6.41
Total	175	23.02	5.62	981	22.06	6.01

R - Repeater NR - Non-repeater

Thus, the speculation that the repeaters in each age group might have pulled down the overall score was eliminated.

However, with the non-repeaters in age groups 15 to 18, Table 20 shows a consistent trend in that the APM scores of 15- and 16-year-old non-repeaters were significantly higher than that of 18-year-old non-repeaters. Such a finding echoes the general relationship between APM scores and age as shown in Table 12.

Table 20

Test of group difference for non-repeaters of age groups 15 to 18 in APM scores

	Age groups			
	18	17	16	15
18				
17				
16	*			
15	*			

* - significantly different at 0.05 level

Educational level

Although there was no significant difference in APM scores between repeaters & non-repeaters of various age groups, there existed significant difference between repeaters and non-repeaters at the Form 4 level. Table 21 showed that repeaters scored higher than non-repeaters ($t=2.12$ ($p<0.05$)).

Table 21

Comparison of APM scores between repeaters & non-repeaters in Form 4

	N	$\bar{X}$	SD	t-VALUE	df	2-TAIL PROB.
R	60	23.20	5.76			
				2.12	807	0.035
NR	749	21.47	6.08			

R - Repeater NR - Non-repeater

$p < 0.05$

No significant difference was found in the APM score between repeaters & non-repeaters in Form 5.

Table 22

Comparison of APM scores

between repeaters and non-repeaters in Form 5

	N	$\bar{X}$	SD	t-VALUE	df	2-TAIL PROB
R	116	22.93	5.53			
				-0.98	686	0.326
NR	572	23.47	5.37			

R - Repeater NR - Non-repeater

$p > 0.05$

Although there was significant difference between the scores of repeaters and the scores of non-repeaters in Form 4, the score of all repeaters as a whole indicated that repeaters did not constitute a factor in pulling down the mean score of each of the 15- to 18-year-old groups.

(3) Private schools

The large number of private school students in age groups 17 to 18 might pull down the means of these age groups. Table 23 shows the distribution of age groups 15 to 18 in Government, Aided and Private schools.

Table 23

Age distribution in 3 types of school

	Age group			
Sch. type	15	16	17	18
Gov't	10.3%	6.5%	8.3%	5.1%
Aided	69.2%	66.6%	45.0%	37.2%
Private	20.5%	26.9%	46.7%	57.7%
Total	100.0%	100.0%	100.0%	100.0%

By breaking down each age group in different types of school, Table 24 shows that 15- to 17-year-old subjects who studied in Government, and Aided Schools scored higher than those in Private schools at 0.05 level.

Table 24

Comparison of APM scores in 3 types of school for age groups 15 to 16

	Age group 15			16			17		
Sch. type	N	$\bar{X}$	SD	N	$\bar{X}$	SD	N	$\bar{X}$	SD
Gov't	35	25.42	5.73	36	24.30	6.05	34	25.44	4.77
Aided	236	24.08	4.71	367	23.84	5.17	184	23.26	5.35
Private	70	18.85	4.97	148	19.19	6.17	191	20.46	5.91
Total	341	23.14	5.34	551	22.60	5.88	409	22.13	5.81

Scheffe Test

Age Groups	15			16			17		
	P	A	G	P	A	G	P	A	G
p				P			P		
A	*			A	*		A	*	
G	*			G	*		G	*	

G - Government A - Aided P - Private

* - Significantly different at 0.05 level

The scene was completely different when the APM scores of subjects from different types of school were compared in age group 18. Table 25 indicated that there was no significant difference among the scores.

Table 25

Comparison of APM scores of age group 18 in Government, Aided, & Private schools

Age group 18

Sch. type	N	$\bar{X}$	SD
Gov't	10	20.9	6.2
Aided	73	21.8	6.2
Private	113	20.7	6.4
Total	196	21.1	6.3

Although in the 18-year-old group no significant difference in APM scores was found among subjects from different types of school, it could not be denied that private school was an important factor in pulling down the mean scores in the age groups 15 to 17 as supported by the significant difference shown in the Scheffe test (Table 24).

(4) Number of subjects in the 18-year-old group

As the sample was drawn on the basis of educational level (i.e. F.4 & F.5), it was unexpected that the number of subjects drawn in the 18-year-old group should turn out to be insufficient to represent this age group when compared with age groups 15 to 17. Table 26 showed the composition of the sample in terms of age.

Table 26

Composition of the sample in terms of age

Age	N	%	APM Mean Scores
15	341	22.7	23.1
16	551	36.8	22.6
17	409	27.3	22.1
18	196	13.2	21.1
Total	1497	100.0	22.4

The possible under-representation of age group 18 might help to explain why the mean APM score for this age group was the lowest.

(5) Items of low discrimination

It was speculated that there might be some items in the test which were of low discriminating power for the age groups 15 to 18. After dropping 8 items (items 1,2,5,6,7,9,11,12) that showed negative discrimination values (discrimination indices by median separation) and 3 items(items 1,2,36) whose discriminating values was below 0.2 (discrimination indices. by bi-serial correlation) as shown in Table 39, the results indicated that age group 15 still scored the highest while age groups 16 to 18 scored on a descending trend in all three APM tests (the 36, 28, 33 items tests). Table 27 showed the mean APM scores in these three tests.

Table 27

Mean APM scores in the 3 APM tests

		36-item test		33-item test		28-item test	
Age Group	N	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
15	341	23.14	5.34	21.19	5.16	15.93	4.77
16	551	22.62	5.88	20.70	5.63	11.50	5.08
17	409	22.13	5.81	20.15	5.60	15.06	4.97
18	196	21.18	6.36	19.36	6.30	14.40	5.17
T	1497	22.42	5.84	20.49	5.60	15.34	5.01

Scheffe Test for group difference

	36-item test				33-item test				28-item test			
Age Group	18	17	16	15	18	17	16	15	18	17	16	15
18												
17												
16	*				*				*			
15	*				*				*			

* - significantly different at 0.05 level

The Scheffe test showed that in the 36-item, 28-item and 33-item tests the mean APM scores of age group 15 and 16 were significantly higher than those of age groups 17 and 18.

Thus, it could be concluded that the degree of difficulty of the test had no relation to the fact that older students scored lower.

In summary, it could be seen that the number of items in the APM test and the number of repeaters in each form were not the causes for the decrease in score with age. However, the mean score of private school students, zeal in taking the test, and the possible under-representation of the 18-year-old group might in combination explain why the highest score was found in the 15-year-old group. Such reasons were by no means exhaustive. Further investigation and analysis of the findings are needed.

Hypothesis 2

The findings confirmed the results of the pilot study, i.e., males scored higher than females ($t(1333.86)=5.53$ at 0.01 level).

Table 28

Comparison of APM scores between males and females

Sex	N	$\bar{X}$	SD	t-VALUE	df	2-TAIL PROB.
Male	903	23.0	5.9			
				5.53	1333.86	.000
Female	594	21.4	5.5			

$p < 0.01$

When subjects were grouped by sex or age, their mean scores showed significant difference. However, when a 2-way interaction of sex and age was analyzed, no significant difference was found.

Table 29

Analysis of Variance by IQ, age and sex

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Main effects	1742.96	4	435.74	13.19	0.00
Age	752.33	3	250.77	7.59	0.00
Sex	1206.16	1	1206.16	36.52	0.00
2-Way interactions	107.06	3	35.68	1.08	0.35
Age Sex	107.06	3	35.68	1.08	0.35
Explained	1850.02	7	264.25	8.00	0.00
Residual	49173.15	1489	33.02		
Total	51023.18	1496	34.10		

Hypothesis 3

Science students scored higher than Arts students at 0.01 level. In fact, Science students seemed to be favoured by their training in performing tasks with spatial figures , therefore this finding was somehow predictable.

Table 30

Comparison of APM scores between Science & Arts students

ACADEMIC

STREAM	N	$\bar{X}$	SD	t-VALUE	df	2-TAIL PROB.
Science	721	24.45	5.23			
				13.81	1485.97	0.000
Arts	776	20.52	5.73			

$p < 0.01$

When the results were broken down, it was found that Arts boys scored better than Arts girls. When sex and academic stream were considered separately, significant difference of mean APM scores was found in different groups, but when a 2-way interaction of sex and academic stream of the subjects was analysed, no significant difference was found. (See table 31)

Table 31

Analysis of Variance by IQ, academic stream and sex

Source of Variation	Sum of Squares	df	Mean Square	F	Significance of F
Main effects	5972.46	2	2986.23	99.00	0.00
Acamst	4981.83	1	4981.83	165.17	0.00
Sex	201.64	1	201.64	6.68	0.01
2-way inter-actions	19.80	1	19.8	0.65	0.41
Acamst sex	19.80	1	19.8	0.65	0.41
Explained	5992.27	3	1997.42	66.22	0.00
Residual	45030.91	1493	30.16		
Total	51023.18	1496	34.10		

Hypothesis 4

The findings in this study did not support the traditional belief that children of small families tended to have a higher IQ due to close parental care and supervision. Table 32 showed that there was no significant difference between subjects from families with more than 2 children (big families) and subjects from families with 2 children or less (small families).

Table 32

Comparison of APM scores between subjects from big families and subjects from small families

Family Size	N	$\bar{X}$	SD	t-VALUE	df	2-TAIL PROB.
Small	377	21.96	5.94			
				-1.78	1495	0.076
Big	1120	22.57	5.79			

$p > 0.05$

The possible reason for explaining the fact that no significant difference was found between subjects from small families and subjects from big families might be attributed to the subjects' heavy exposure to the mass media of which television exerts the greatest impact on the subjects' intellectual development. Disregard the family size, nearly every subject in Hong Kong has a television at home. Their chances of exposure to knowledge, intellectual thinking provided by televsion programmes are more or less the same. Hence, the mass media can to a certain extent replace the classical role of parents who are supposed to transmit knowledge, develop their siblings' thinking especially in the case where the family size is small. The frequent exposure and influence by mass media might be a possible factor that suggests the reason why subjects from both small and big families have no significant difference in their APM scores.

Hypothesis 5

The occupational classification in this research was based on a research of 'People of Kwun Tong 1975' done by the Social Research Centre of the Chinese University of Hong Kong. The full list was included in Appendix 4.

Among the 13 groups of occupations, there was no data entry for Group 4 - Messengers. Table 33 showed that subjects whose parents were engaged in 'Service work" had the highest APM score. The parents of these subjects were mostly professionals or intellectuals. Therefore it was not surprising to see that this group of subjects could enjoy better parental guidance, caring and better home environment which helped intellectual development.

Table 33

Comparison of APM scores of subjects classified by parents' occupations

Parents' Occupation	N	$\bar{X}$	SD
1.Professional	40	24.60	6.10
2.Senior clerk	215	22.93	5.80
3.Junior Clerk	86	23.62	6.00
5.Technologist	16	25.18	3.90
6.Technician	140	23.20	5.21
7.Semi-skilled	346	21.79	6.03
8.Unskilled	102	21.88	5.87
9.Service (higher professionals)	38	25.31	4.15
10.Service(lower professionals)	34	22.61	5.38
11.Personal Service	165	22.18	5.39
12.Unskilled Service	157	21.70	6.43
13.Others	158	21.48	5.70
Total	1497	22.42	5.84

As similarities could be found among certain groups of occupations, these were collapsed into 4 broad categories. Groups 1 to 4 were merged to produce the classification 'Administration & Clerical work'; groups 5 to 8 were merged to yield 'Production Work'; groups 9 to 12 were merged to form the classification 'Service Work'; and group 13 was included to yield 'Others'. (See Appendix 2)

When the 4 broad categories were considered, the results indicated that subjects whose parents were engaged in Administrative & Clerical work scored the highest whereas subjects whose parents were unskilled labourers or unemployed had the lowest APM score.

Table 34

Comparison of APM scores of 4 groups of subjects classified by their parents' occupations

Occupations group	N	$\bar{X}$	SD
1. Administrative/ Clerical	341	23.30	5.90
2. Production	604	22.22	5.81
3. Service	394	22.33	5.80
4. Others	156	21.48	5.70
Total	1497	22.42	5.84

According to the result of the Scheffe Test, subjects whose parents were engaged in Administrative & Clerical work scored significantly higher than subjects whose parents were engaged in Production or Service or 'Others'.

Table 35

Test of group difference of subjects as classified by their parents' occupations

	Occupational Groups			
	4	2	3	1
4				
2				
3				
1	*			

* - significantly different at 0.05 level

Hypothesis 6

Subjects in Government schools obtained the highest APM score, those in Aided schools the second and those in Private schools ranked bottom.

Table 36

APM scores in 3 types of school

School types	N	$\bar{X}$	SD
1. Gov't	115	24.66	5.68
2. Aided	860	23.61	5.21
3. Private	522	19.95	6.03
Total	1497	22.42	5.84

The Scheffe result showed that subjects in both government and aided schools scored significantly higher than subjects in private schools, but there was no significant difference between subjects in government schools and subjects in aided schools.

Table 37

Test of scoring difference in 3 types of school

School type	Gov't	Aided	Private
Gov't			
Aided	*		
Private	*		

* - significantly different at 0.05 level

The reason for the difference in APM scores between subjects from government or aided schools and those from private schools could be a result of the present secondary place allocation system under which the best students are allocated to government and aided schools while the less brilliant students are placed in private schools.

Hypothesis 7

The hypothesis that subjects living in the urban area scored higher than subjects in the non-urban area was found to be untrue. Table 38 showed that there was no significant difference in APM scores between subjects studying in Hong Kong, and those studying in Kowloon or in the New Territories.

Table 38

APM mean scores of groups classified by regional divisions

Regions	N	$\bar{X}$	SD
Hong Kong	363	22.31	5.93
Kowloon	778	22.53	5.98
New Territories	356	22.28	5.42
Total	1497	22.42	5.84

D. Item Analysis

(1) Overall results

Facility Value - The overall Facility Values (percentage of subjects giving correct answer) and discrimination indices of the individual items for the whole study were presented in Table 39. It could be observed that the easiest items were 1 to 7 while items 27 to 29, 32 to 36 were very difficult with Facility Values under 40%. The trend showed that the difficulty of each item increased from Item 24 onwards.

Discrimination Indices - There were two methods for computing the discrimination indices. Discrm-I was done by median separation in which the formula is $\frac{U-L}{N}$ *. This method was crude when compared with Discrm-L which was calculated by Bi-serial correlation.

According to Ebel (1965), with a sample of 1497 subjects, a test item can be described as discriminating when its discrimination index (bi-serial correlation) reaches 0.06, thus it can be said that all the 36 items have a great ability in discriminating intelligent students from the less intelligent ones in the age groups 15 to 18. (See Table 39)

* U - Upper APM means group
L - Lower APM means group
N - Total number of items

Table 39

Overall results of facility values &

discrimination indices of the test items

***** ITEM PARAMETERS *****

ITEM	FACILITY	DISCRM-I	DISCRM-L
1	92.1176	-0.064951	0.177622
2	89.7128	-0.040441	0.194541
3	88.5772	0.012255	0.273236
4	85.6379	0.036765	0.278487
5	85.4375	-0.008578	0.206016
6	89.3788	-0.029412	0.210426
7	89.1116	-0.002804	0.241815
8	77.2879	0.094863	0.290307
9	91.0488	-0.013480	0.262945
10	79.5591	0.161127	0.356608
11	87.3079	-0.003676	0.231446
12	84.1015	-0.001225	0.206427
13	75.6851	0.093137	0.279792
14	83.0827	0.057598	0.264299
15	75.2171	0.098039	0.282031
16	80.4275	0.090686	0.306654
17	73.1463	0.113971	0.290190
18	50.3674	0.242647	0.356836
19	76.4863	0.050245	0.228157
20	67.3347	0.139706	0.293045
21	64.4623	0.273284	0.434459
22	53.6406	0.310049	0.437696
23	61.2558	0.292892	0.442914
24	48.0294	0.256127	0.367684
25	50.3674	0.252451	0.367568
26	40.0134	0.182598	0.277943
27	28.3333	0.203431	0.304035
28	27.7889	0.178922	0.274780
29	24.9833	0.178922	0.278459
30	43.0862	0.256127	0.361872
31	45.4910	0.253676	0.361541
32	24.8497	0.186275	0.287991
33	33.1329	0.193627	0.288890
34	23.8577	0.252843	0.356932
35	35.4041	0.232843	0.333523
36	11.3560	0.090686	0.188849

Discrm-I - Median Separation
Discrm-L - Bi-serial correlation

(2) Age groups 15 to 18

Tables 40 and 43 showed that the 36 items for students in age groups 15 and 18 had high discriminating power as no item had a negative value. On the other hand, results in Tables 41 and 42 indicate that the discriminating power of some of the test items was low for students in age groups 16 and 17. Comparing the discriminating power of the 36 items between age groups 16 and 17, an even lower discriminating power was discovered with age group 17 as one-third of the total number of items had negative values (Discrm-I).

Table 40

Facility values & discrimination indices of the test items for the age group 15

***** ITEM PARAMETERS *****

ITEM	FACILITY	DISCRM-I	DISCRM-L
1	92.0821	0.070175	0.140328
2	89.7361	0.093567	0.163277
3	91.4956	0.116959	0.219878
4	85.9238	0.192982	0.285512
5	87.3900	0.081871	0.131397
6	89.7361	0.116959	0.201929
7	91.7889	0.134503	0.255490
8	79.4721	0.192982	0.245368
9	94.1349	0.076023	0.173996
10	85.3372	0.251462	0.368558
11	91.2023	0.111111	0.206147
12	85.0440	0.081871	0.122112
13	79.1789	0.152047	0.193505
14	87.3900	0.198830	0.308076
15	76.2463	0.304094	0.368578
16	81.2317	0.251462	0.329055
17	76.2463	0.222222	0.267106
18	54.8387	0.380117	0.386263
19	77.4194	0.163743	0.201817
20	69.7947	0.198830	0.221615
21	69.5015	0.391813	0.431189
22	57.1848	0.450292	0.459740
23	65.3959	0.415205	0.441722
24	49.5601	0.286550	0.290309
25	53.9589	0.315789	0.320889
26	43.1085	0.321637	0.328243
27	28.7390	0.280702	0.312910
28	24.6334	0.210526	0.246695
29	26.3930	0.222222	0.254585
30	47.2141	0.368421	0.372851
31	45.1613	0.304094	0.309086
32	20.6862	0.239766	0.273598
33	35.7771	0.315789	0.332554
34	29.0323	0.333333	0.370133
35	33.4311	0.315789	0.337762
36	13.1965	0.134503	0.200430

Discrm-I - Median separation
Discrm-L - Bi-serial correlation

Table 41

Facility values & discrimination indices of the test items for the age group 16

***** ITEM PARAMETERS *****

ITEM	FACILITY	DISCRM-I	DISCRM-L
1	93.2849	-0.060811	0.147225
2	69.8367	-0.023649	0.179683
3	89.1107	0.050676	0.301089
4	87.2958	0.037162	0.255711
5	85.1180	0.023649	0.214244
6	90.1996	-0.030405	0.171280
7	89.6367	-0.003378	0.215820
8	77.8584	0.125000	0.302103
9	91.4701	0.013514	0.270407
10	80.0363	0.156784	0.363391
11	86.3884	0.033784	0.241052
12	85.8439	-0.003378	0.176527
13	76.2250	0.114865	0.278959
14	84.9365	0.067568	0.278942
15	74.4102	0.108108	0.260700
16	81.8512	0.084459	0.276510
17	74.7731	0.141892	0.304458
18	51.3612	0.287162	0.386179
19	77.8584	0.077703	0.240737
20	68.0581	0.145270	0.276760
21	64.7913	0.300676	0.440347
22	54.0835	0.351351	0.460795
23	60.0726	0.327703	0.451981
24	49.0018	0.317568	0.415357
25	50.4537	0.283784	0.381058
26	39.0200	0.206081	0.287275
27	28.4936	0.219595	0.309174
28	31.5789	0.263514	0.356082
29	25.4083	0.216216	0.311097
30	43.3757	0.266892	0.355413
31	43.3757	0.226351	0.311346
32	27.0417	0.239865	0.336337
33	33.2123	0.185811	0.265148
34	30.1270	0.209459	0.294927
35	37.5681	0.273649	0.362269
36	9.4374	0.094595	0.198393

Discrm-I - Median separation
Discrm-L - Bi-serial correlation

Table 42

Facility values & discrimination indices of the test items for the age group 17

***** ITEM PARAMETERS *****

ITEM	FACILITY	DISCRM-I	DISCRM-L
1	92.6650	-0.13362	0.188959
2	90.7090	-0.11638	0.194549
3	87.7751	-0.07328	0.235584
4	85.5746	-0.02586	0.288393
5	84.1076	-0.06034	0.217711
6	89.4866	-0.06897	0.267212
7	89.4866	-0.09483	0.218946
8	77.2616	0.00862	0.261926
9	90.7090	-0.08190	0.262544
10	76.2836	0.07759	0.347802
11	86.7971	-0.07328	0.224044
12	82.8851	-0.03017	0.252786
13	74.3276	0.07759	0.332583
14	82.3961	-0.01293	0.274161
15	75.3056	0.00000	0.236983
16	80.4401	0.03879	0.331188
17	70.4156	0.09483	0.328297
18	47.6773	0.17672	0.332086
19	76.7726	-0.00862	0.235034
20	66.0147	0.12069	0.334995
21	60.3912	0.21983	0.424861
22	51.8937	0.23276	0.407437
23	60.1467	0.20690	0.408619
24	46.6993	0.22845	0.389141
25	47.6773	0.21121	0.371609
26	38.8756	0.09052	0.214521
27	28.3619	0.13793	0.260554
28	26.1614	0.07328	0.176214
29	22.9829	0.12069	0.238344
30	41.0758	0.19828	0.344010
31	46.2103	0.28017	0.447470
32	24.4499	0.12069	0.237947
33	32.7628	0.15517	0.283985
34	28.1174	0.23707	0.386733
35	36.1856	0.21552	0.358924
36	14.4254	0.09914	0.217239

Discrm-I - Median separation
Discrm-L - Bi-serial correlation

Table 43

Facility values & discrimination indices of the test items for the age group 18

***** ITEM PARAMETERS *****

ITEM	FACILITY	DISCRM-I	DISCRM-L
1	87.7551	0.116505	0.323773
2	87.2449	0.087379	0.271439
3	83.6735	0.155340	0.336804
4	80.6122	0.135922	0.285086
5	85.7143	0.077670	0.241981
6	86.2245	0.029126	0.172281
7	81.6327	0.155340	0.318794
8	71.9388	0.300971	0.434279
9	85.2041	0.165049	0.367195
10	75.0000	0.223301	0.359840
11	84.1837	0.106796	0.271867
12	80.1020	0.203883	0.371223
13	72.4490	0.194175	0.311537
14	71.4286	0.213592	0.329564
15	75.5102	0.194175	0.327305
16	75.0000	0.223301	0.359840
17	68.8776	0.145631	0.241510
18	45.4082	0.184466	0.241546
19	70.4082	0.116505	0.213107
20	63.7755	0.320388	0.416534
21	63.2653	0.388350	0.490929
22	50.0000	0.407767	0.480217
23	59.6939	0.398058	0.489186
24	45.4082	0.242718	0.303111
25	49.4898	0.300971	0.367324
26	39.7959	0.213592	0.271150
27	27.0408	0.242718	0.318643
28	26.0204	0.203883	0.274619
29	25.5102	0.252427	0.334600
30	39.2857	0.300971	0.365366
31	50.5102	0.339806	0.409238
32	16.3265	0.174757	0.271361
33	29.0816	0.203883	0.268947
34	26.5306	0.252427	0.331554
35	31.1224	0.087379	0.133647
36	7.1429	0.000000	0.014169

Discrm-I - Median separation
Discrm-L - Bi-serial correlation

(3) Discrimination value due to educational level

Table 44 indicates that only Item No. 1 had negative discriminating power when the test was used for Form 4 students. However, when it was used for Form 5 students there were large number of items which had negative discriminating power. Such a phenomenon may suggest that it is less appropriate to use the APM test for F.5 students, and if it is used, the .9 items (items 1,2,4,5,6,7,9,11,12) which have negative values of discriminating power should be dropped.

Table 44

Facility values & discrimination indices of the test items for Form 4 students

***** ITEM PARAMETERS *****

ITEM	FACILITY	DISCRM-I	DISCRM-L
1	91.1001	-0.002326	0.197744
2	88.0099	0.009302	0.186387
3	86.7736	0.083721	0.293410
4	83.1891	0.127907	0.322674
5	84.1780	0.034884	0.196605
6	87.2682	0.041860	0.232258
7	87.6391	0.067442	0.277322
8	74.2892	0.174419	0.319920
9	89.8640	0.058140	0.290678
10	78.4920	0.211628	0.394982
11	86.7736	0.065116	0.264162
12	82.8183	0.051163	0.210915
13	73.1768	0.158140	0.294432
14	80.3461	0.176744	0.364593
15	72.3115	0.193023	0.331822
16	78.1211	0.176744	0.347044
17	71.0754	0.193023	0.325743
18	47.3424	0.300000	0.379894
19	75.4017	0.102326	0.237132
20	66.2546	0.167442	0.277105
21	61.4339	0.341860	0.453771
22	48.9493	0.428256	0.512787
23	56.8603	0.320930	0.417625
24	45.8591	0.276744	0.359928
25	47.4660	0.288372	0.367600
26	38.0717	0.218953	0.284197
27	24.7219	0.195349	0.277367
28	24.7219	0.176744	0.254399
29	21.7553	0.139535	0.213426
30	41.0383	0.269767	0.344773
31	40.6675	0.239535	0.312002
32	22.9913	0.195349	0.281768
33	32.2621	0.234884	0.311186
34	25.2163	0.246512	0.359067
35	32.5093	0.244186	0.321478
36	11.7429	0.109302	0.203863

Discrm-I - Median separation
Discrm-L - Bi-serial correlation

Table 45

Facility values & discrimination indices of test items for Form 5 students

***** ITEM PARAMETERS *****

ITEM	FACILITY	DISCRM-I	DISCRM-L
1	93.3140	-0.074866	0.163489
2	91.7151	-0.040107	0.211676
3	90.6977	-0.016043	0.243214
4	88.5174	-0.008021	0.229332
5	86.9186	-0.021390	0.191042
6	91.8605	-0.042781	0.208719
7	90.8430	-0.045455	0.189734
8	80.8140	0.064171	0.268597
9	92.4419	-0.032086	0.239921
10	80.8140	0.085561	0.298240
11	87.9360	-0.002674	0.231872
12	85.6105	-0.008021	0.201060
13	79.0698	0.056824	0.249057
14	88.1919	-0.013369	0.197572
15	78.6337	0.050802	0.235575
16	83.1395	0.042781	0.256749
17	75.5814	0.080214	0.255905
18	53.9244	0.200535	0.314240
19	77.7616	0.029412	0.203296
20	68.6047	0.125342	0.280818
21	68.0283	0.213904	0.377955
22	58.1570	0.246316	0.375472
23	66.4244	0.270053	0.435176
24	50.5814	0.278075	0.392069
25	53.7791	0.235294	0.351959
26	42.2965	0.169840	0.284638
27	32.5581	0.187166	0.278784
28	31.3953	0.187166	0.279290
29	28.7791	0.213904	0.313469
30	45.4942	0.280749	0.387631
31	51.1628	0.213904	0.323114
32	27.0349	0.192513	0.289815
33	34.1570	0.227273	0.324566
34	33.1395	0.224599	0.322002
35	38.8081	0.232620	0.330200
36	10.9012	0.096930	0.203841

Discrm-I - Median separation
Discrm-L - Bi-serial correlation

E. Modified APM Tests

(1) Means, reliabilities and scores distribution

In order to test if there was any change of the mean score in relation to age and other social variables when certain items were dropped from the original test, two modified versions were made. They were a 28-item test and a 33-item test.

The 28-item test was created by dropping 8 items (items 1,2,5,6,7,9,11,12) which showed negative discriminating values with Discrm-I in Table 39. The 33-item test was made by dropping 3 items (1,2,36) whose values were less than 0.2 with Discrm-L in Table 39.

Main studies of the modified 28-item test and the 33-item test were analyzed.

(1) Comparison of means, standard deviations & reliabilities of the three APM tests

Table 46

Comparison of means, standard deviations in 3 versions of the test

	No of items		
	36	33	28
$\bar{X}$	22.42	20.49	25.34
SD	5.84	5.60	5.01

(II) Reliability of the instrument was high as the values of the Cronbach and Split Half of these 3 tests were very close.

Table 47

Reliabilities in 3 versions of the test

	No of items		
	36	33	28
1. K.R. 20	.84	.83	.80
2. SPILT HALF			
Part 1	.76	.75	.72
Part 2	.73	.73	.68
Spearman Brown	.73	.73	.72

(III) The distribution of scores for the 28-item test and that for the 33-item test are shown in Table 48 and Table 49 respectively. The distribution was normal. Marks frequency for the 28-item test is shown in Table 50 and that for the 33-item test is shown in Table 51.

Table 48

Distribution of the 28-item APM test scores

COUNT MIDPOINT ONE SYMBOL EQUALS APPROXIMATELY 8.00 OCCURRENCES

```
  0    -1.0
  3      .5
  5     2.0  :
 22     3.5  :**
 16     5.0  **.
 52     6.5  ****:**
 46     8.0  ****** .
105     9.5  **********:**
 79    11.0  **********    .
186    12.5  ******************:****
118    14.0  ***************     .
226    15.5  **********************:******
120    17.0  ***************     .
193    18.5  ******************:******
 90    20.0  **********  .
127    21.5  **********:*****
 41    23.0  ***** .
 42    24.5  ***:*
 16    26.0  *:
  8    27.5  :
  0    29.0  .
          I....+....I....+....I....+....I....+....I
          0        80       160       240       320
                HISTOGRAM FREQUENCY
```

Table 49

Distribution of the 33-item APM test scores

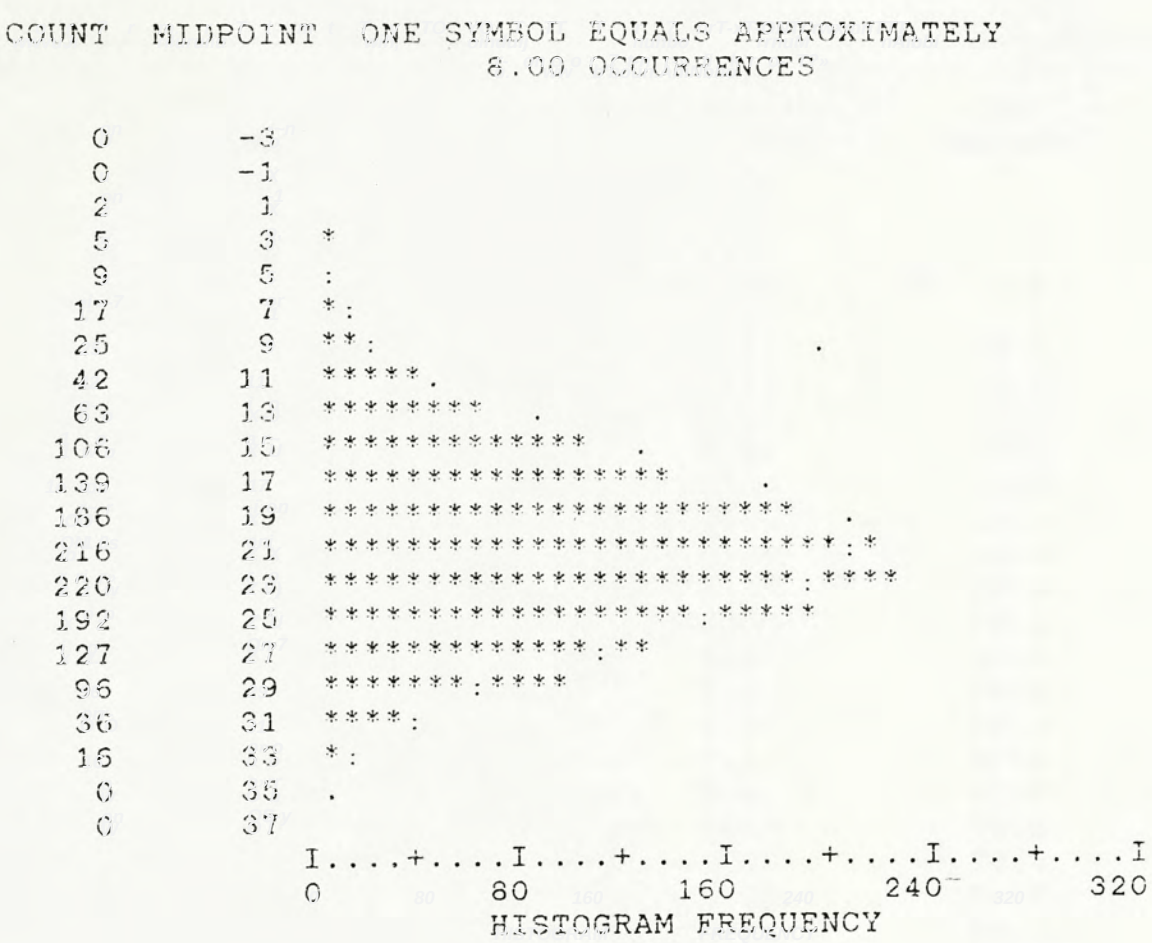


Table 50

Marks frequency of the 28-item test

VALUE	FREQUENCY	PERCENT	CUM PERCENT
.00	1	.1	.1
1.00	2	.1	.2
2.00	5	.3	.5
3.00	5	.3	.9
4.00	17	1.1	2.0
5.00	16	1.1	3.1
6.00	28	1.9	4.9
7.00	24	1.6	6.5
8.00	48	3.2	9.8
9.00	55	3.7	13.4
10.00	50	3.3	16.8
11.00	79	5.3	22.0
12.00	90	6.0	28.1
13.00	96	6.4	34.5
14.00	118	7.9	42.4
15.00	120	8.0	50.4
16.00	106	7.1	57.4
17.00	120	8.0	65.5
18.00	107	7.1	72.6
19.00	86	5.7	78.4
20.00	90	6.0	84.4
21.00	65	4.3	88.7
22.00	62	4.1	92.9
23.00	41	2.7	95.6
24.00	26	1.9	97.5
25.00	14	.9	98.4
26.00	16	1.1	99.5
27.00	5	.3	99.8
28.00	3	.2	100.0
TOTAL	1497	100.0	

Table 51

Marks frequency of the 33-item test

VALUE	FREQUENCY	PERCENT	CUM PERCENT
1.00	2	.1	.1
2.00	2	.1	.3
3.00	3	.2	.5
4.00	3	.2	.7
5.00	6	.4	1.1
6.00	10	.7	1.7
7.00	7	.5	2.2
8.00	13	.9	3.1
9.00	12	.8	3.9
10.00	18	1.2	5.1
11.00	24	1.6	6.7
12.00	33	2.2	8.9
13.00	30	2.0	10.9
14.00	51	3.4	14.3
15.00	55	3.7	18.0
16.00	59	3.9	21.9
17.00	80	5.3	27.3
18.00	88	5.9	33.1
19.00	98	6.5	39.7
20.00	104	6.9	46.6
21.00	112	7.5	54.1
22.00	106	7.1	61.2
23.00	114	7.6	68.8
24.00	102	6.8	75.6
25.00	90	6.0	81.6
26.00	71	4.7	86.4
27.00	56	3.7	90.1
28.00	63	4.2	94.3
29.00	33	2.2	96.5
30.00	19	1.3	97.8
31.00	17	1.1	98.9
32.00	11	.7	99.7
33.00	5	.3	100.0
TOTAL	1497	100.0	

(2) Findings of the revised versions of APM

The 28-item test and 33-item test were analyzed in relation to the seven hypotheses set in Chapter IV, the results were as follows.

First, the 15-year-old subjects scored higher than age groups 16 to 18 remained unchanged in these 3 tests. The Scheffe result indicated that in both the 36-item and the 33-item tests, age groups 15 and 16 scored significantly higher than age groups 17 and 18 while in the 28-item test only age group 15 scored significantly higher than age groups 16 to 18. (See Table 27)

Second, males scored significantly higher than females at 0.01 level. This finding applies to all three tests. (See Table 52)

Third, science students scored higher than arts students at 0.01 level in all three tests. (See Table 53)

Fourth, no significant difference was found between subjects from families with more than 2 children and subjects from families with 2 children or less in the 36-item, 28-item and 33-item tests.

Fifth, both the 28-item and the 33-item tests had the same result as in the 36-item test in that subjects whose parents were engaged in administrative work scored the highest while subjects whose parents were classified under group 4 i.e. 'others' had the lowest score. (See Table 54) Scheffe result also indicates that subjects whose parents were engaged in administrative work scored higher than parents who engaged in production, service and 'others' at 0.05 level.

Sixth, the findings were highly consistent in the 3 tests with students from government and aided schools scoring higher than students in private schools at 0.05 level. (See Table 55)

Seventh, no significant difference in APM scores was found between subjects in Hong Kong and those in Kowloon or the New Territories in the 36-, 28- and 33-item tests.

The findings for the seven hypotheses were exactly the same with the original 36-item test and with the 2 modified versions of the APM.

(3) Repeaters

Table 56 showed that with the 36-, 28-, 33-item tests, no significant difference in APM scores was found between

(i) all repeaters & all non-repeaters ;

(ii) 15- to 18-year-old repeaters and 15- to 18-year-old non-repeaters ; and

(iii) Form 5 repeaters & Form 5 non-repeaters .

However, significant difference appeared between repeaters and non-repeaters of F.4 in APM scores. There was also significant difference among non-repeaters of age groups 15 to 18 where the result of Scheffe test confirmed that non-repeaters of age groups 15 and 16 scored higher than those in age groups 17 and 18. (See Table 57)

Table 52

Test of group difference between males and females in the 3 versions of the APM

36-item test	33-item test	28-item test
$t(1333.86)=5.53$	$t(1338.14)=5.51$	$t(1337.62)=5.93$
$p < 0.01$		

Table 53

Test of group difference between Science and Arts students in the 3 versions of the APM

36-item test	33-item test	28-item test
$t(1485.97)=13.81$	$t(1494.96)=13.66$	$t(1485.97)=13.81$
$p < 0.01$		

Table 54

Comparison of APM scores among subjects grouped according to parents' occupations in the 3 APM tests

Parents Occupation		36-item test		33-item test		28-item test	
	N	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
1.Administrative	341	23.31	5.98	21.34	5.72	16.10	5.24
2. Production	604	22.33	5.81	20.29	5.54	15.15	4.96
3. Service	394	22.22	5.80	20.41	5.54	15.26	4.95
4. Others	156	21.48	5.70	19.58	5.51	14.53	4.71
Total	1497	22.42	5.84	20.49	5.60	15.34	5.01

Scheffe test

	36-item test				33-item test				28-item test			
Occ. groups	4	2	3	1	4	2	3	1	4	2	3	1
4												
2												
3												
1	*				*				*	*		

* - significantly different at 0.05 level

Table 55

Comparison of APM scores among subjects grouped according to school types in the 3 APM tests

School		36-item test		33-item test		28-item test	
Type	N	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
1.Gov't	115	24.68	5.68	22.60	5.50	17.33	5.17
2.Aided	860	23.61	5.21	21.66	4.98	16.35	4.63
3.Private	522	19.95	6.03	18.08	5.77	13.22	4.89
Total	1497	22.42	5.84	20.49	5.60	15.34	5.01

SCHEFFE TEST

	36-item test			33-item test			28-item test		
	3	2	1	3	2	1	3	2	1
3									
2	*			*			*		
1	*			*			*		

* - Significantly different at 0.05 level

Table 56

Comparison of APM scores between repeaters & non-repeaters in the 3 APM tests

	36-item test	33-item test	28-item test
1. Overall Result			
R - 176(11.75%)			
NR -1321(88.25%)	No significant difference		
2. Age			
Age R NR			
15 1 340			
16 34 517			
17 85 324	No significant difference		
18 56 140			
Total 176 1321			
3. Educational Levels			
Form 5			
R - 116 (16.8%)			
NR - 572 (83.2%)	No significant difference		
Form 4			
R - 60 (7.5%)			
NR - 749 (92.5%)	t(69.94)=2.21*	t(69.46)=2.01*	t(68.98)=2.02*

* - significantly different at 0.01 level

R - Repeater NR - Non-repeater

Table 57

APM scores of non-repeaters in age groups 15 to 18 in the 3 APM tests

		36-item test		33-item test		28-item test	
Age	N	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
15	340(99.7%)	23.14	5.35	21.19	5.17	15.93	4.78
16	517(93.8%)	22.52	5.88	20.60	5.62	15.40	5.05
17	324(79.2%)	21.93	5.95	19.96	5.74	14.69	5.01
18	140(71.4%)	20.65	6.41	18.85	6.13	13.95	5.21
T	1321(100%)	22.34	5.86	20.41	5.63	15.27	5.04

Scheffe test

36-item test					33-item test					28-item test				
	18	17	16	15		18	17	16	15		18	17	16	15
18					18					18				
17					17					17				
16	*				16	*				16	*			
15	*				15	*				15	*			

* - Significantly different 0.05 level

CHAPTER VI

DISCUSSION

A. Summary of findings

The mean score (22.42 with SD 5.84) obtained in this study was higher than that of the university students (X=21, SD=4)who did the APM test in 1962. (See p.25 of the 1975 APM Manual) The mean score of this study was also close to that of the New Zealand tertiary students whose mean was 22.55 and the standard deviation was 4.49 (Appendix 5). The mean score of Hong Kong 15-year-old sample was much higher than their German counterparts.

The reliability of the instrument was high as the value of Cronbach Alpha was close to the 15-year-old German sample's while the value of split half kept abreast with that of the southern states group of university students.

It was found that sex, academic stream, parents' occupations and school type had significant effects on APM scores whereas difference in family size, and regional division had no significant effects on them. All these findings remained unchanged even when the tests were reanalyzed by dropping 8 items (Discrm-I) and 3 items (Discrm-L) as in Table 39.

The fact that the 15-year-old group scored the highest while the 16- to 18-year-old groups had a descending score occurred consistently in the 36-item, 28-item and 33-item tests. Possible reasons for explaining this special phenomenon, such as the number of repeaters and the unsuitability of some items in the 36-item APM test were eliminated after a detailed analysis.

However, it was possible that zeal in taking the test, number of students in private schools and the comparatively small sample of the 18-year-old group might help to explain the phenomenon that 15-year-old subjects scored higher than those in age groups 16 to 18.

B. Limitations and implications

Limitations

The fact that this APM test was undertaken by one person only, and with limited resources mean that no more than 2% of the total number of HKCEE students in 1985 could be taken up for the study. Hence, the size of the sample may not be representative enough of the Hong Kong age groups 15 to 16 in APM performance. As only one Government school was drawn in each region, the representation of this group of subjects may not be as high as one percent of subjects chosen in each of the 35 Government schools.

Implications

As stated in Section C of Chapter I, the purpose of this study was to investigate how well 15- to 16-year-old subjects could perform in the APM test. Three questions arise from the findings.

(1) How suitable is the APM for the 15- to 16-year-old groups?

(2) Are there any items to be eliminated?

(3) What are the causes accounting for the low score of the 16-year-old group?

Following are some attempts to answer these three questions.

Suitability of the APM test for the 15- to 16-year-old groups

As the APM was designed in 1947, the content of the test might not be suitable for testing the intelligence of students aged over 15 after a lapse of 39 years. Throughout these years, there were social and educational changes which might have impact on the intellectual development of 15- to 18-year-olds. Coupled with the exposure to more reasoning tests in primary and secondary school, subjects might not find the test so difficult as compared to when the 1962 APM version was constructed. It might take more time to observe how suitable the APM test is in testing students in age groups 15 to 18. However, it was also essential to bear in mind that the 15-year-old group in this study had reached the top mean APM score among the age groups 15 to 18.

Shortening the test

As the results remained unchanged even when the original test was reanalyzed with the modified 28-item test and the 33-item test, it might be suggested that the shorter version of 28 items be used for testing age groups 15 to 18 in future. The items to be dropped are 1, 2, 5, 6, 7, 9, 11, 12. (See Table 39 Discrm-I) This shorter APM version can reduce the time for age groups 15 to 18 in tackling the test while it would also

achieve the same purpose as the original one.

The other possibility of improving the test is to invent new items to replace the deleted ones. Such new items should have higher discriminating power in testing the intelligence of students in age groups 15 to 18.

Caution has to be taken when the test is given to 17-year-old subjects in form 5 for nearly one-third of the total number of items show a negative discriminating power with this group. It is worthwhile trying to eliminate these 12 items and investigate how well the modified APM test can be performed not only by the 17-year-old group but also by 15-, 16- and 18-year-olds.

Reasons for the low score of the 18-year-old group

There are two explanations for the low score of the 18-year-old group in this sample. It may be that the 18-year-old group in this sample is really less brilliant than age groups 15 to 17 as supported by the findings that they scored the lowest and that there was no significant difference between repeaters and non-repeaters in this age group. It may also be argued that the 18-year-old group is under-represented which leads to the lowest APM scores among the 4 age groups. At this stage, it is hard to decide which contention is right and further exploration is needed to yield the true reason.

One fact worth noting was the finding that the 15-year-old group had reached the top mean APM score among the age groups 15 to 18 in all the 36-item, 28-item and 33-item tests. This might well indicate that the test does not have great enough discriminating power for testing subjects above the age of 15.

It should also be pointed out that the number of subjects in each group was not randomly drawn according to educational level, therefore the number of subjects drawn in each age group was not proportionate to the size of age groups 15 to 18.

Unlike the pilot study in which the author could collect the data of mock examination results of four F.5 classes in her school, the author experienced technical difficulty in obtaining such data in the main study as most schools declined to disclose the academic results of their students. Therefore, it is not possible to correlate the APM scores with academic achievements.

Anastasi (1976) pointed out that the manual for the progressive matrices was inadequate, giving little information on reliability and none on validity.

Despite efforts to collect information on the validity of the APM test for the 15 to 18-year-old groups, (e.g. by writing to the APM authorities Raven, Court and searching ERIC journal up to march,1986), no data could be discovered for comparison with the findings of this study.

Note

[1] John Court of Flinders University of South Australia is an expert APM researcher. His work relating to the research of the APM can be found on the first page of the APM Manual 1975.

[2] John Raven is the son of the late Mr J.C.Raven who invented the APM. He is currently working in the Scottish Council for Educational Research.

Bibliography

Anastasi, Anne (1976) Psychological Testing. New York: Macmillian.

Buros, Oscar K. (ed.) (1961) Tests in Print. Highland Park, New Jersey: Gryphon Press.

Buros, Oscar K.(1972) The Eighth Mental Measurement Yearbook. Highland Park, New Jersey: Gryphon Press.

Chan, Jimmy (1984) 'Raven's Progressive Matrices Test', New Horizons, 25, 43-49.

Cheng, W.H. (1984) 'The standardisation of Raven's Progressive Matrices test for use with HK pupils' Selected Papers on Educational Research in HK - First Annual Conference, HK Educational Research Association.

Court, H. John (1982) Researchers bibliography for Raven's Progressive matrices and Mill Hill Vocabulary Series Supplement, Flinders University of South Australia.

Dillon, R.F. (1980)'Matching students to their preferred testing conditions: improving the validity of cognitive assessment', Applied Psychological Measurement, 40, 999-1004.

Dillon, R.F.& Wisher, R.A. (1981) 'The predictive validity of eye movement indices for technical school qualifying test performance', Applied Psychological Measurement, 5, 43-49.

Ebel, Robert L.(1965) Measuring educational achievement. Englewood Cliff, N.J.: Prentice Hall.

Fabian, J.S and Parsons, O.A. (1983) 'Different Improvement of Cognitive functions in recovering alcoholic women', Journal of Abnormal Psychgology, 92, 1, 87-95.

Forbes, A.R. (1964) ' An item analysis of the Advanced Matrices', British Journal of Educational Psychology, 34, 1-14.

Foulds, G.A. (1949) 'Variations in the intellectual activities of adults', American Journal of Psychology, 62, 238-246.

Foulds, G.A. & Raven J.C. (1950)'An Experimental Survey with Progressive Matrices 1947', British Journal of Educational Psychology, 20, 104-110.

Hau, Kit Tai (1981) Educational tests, Assignment for an Educational Psychology course (unpublished).

Hesse, F.W. (1982)'The effects of semantic contexts on the solution of complex problems', Zeitshrift fur experimentelle and angewandte Psychologie, 29, 1, 62-91.

Hong Kong Examinations Authority (1985) List of 1985 HKCEE Participating Schools.

Horn R. (1979) German APM Manual, Beltztest, Weinheim.

Horn R. (1982) Typescript from currently published APM Manual.

Isaac S. & Michael W.B. (1971) Handbook in Research and Evaluation. San Oiego, Calif: R.R. Knapp.

Jones, B.M. (1974)'Circadian variation in the effects of alcohol on cognitive performance', Quarterly Journal of Studies in Alcohol, 53, 1212-1219.

Kerlinger, F.N.(1973) Foundations of Behavioral Research. New York: Holt, Rinehart & Winston.

Kish, G.B.Hagen, J.M., Woody, M.M.& Harvey, H.L. (1980) 'Alcoholics recovery from cerebral impairment as a function of duration of abstinence', Journal of Clinical Psychology, 36, 584-599.

Lapsley D.K. and Enright, R.D.(1979).'The effects of social desirability, intelligence and Milieu on an American Validation of the Conservatism scale', Journal of Social Psychology, 103, 9-14.

Linton, P.H. Kuechermeister, C.A. & White, H.B. (1976) 'DRUG preference and response to marijuana and alcohol', Research among Communications in Psychology, Psychiatry and Behavior, 1, 629-643.

Lynn, R. & Gordon, I.E. (1961) 'The relation of neuroticism and extraversion to intelligence and educational attainment', British Journal of Educational Psychology, 31, 194-203.

McDonald, P. Roderick (1965)'Difficulty factors and non-linear factor analysis', British Journal of Mathematical and Statistical Psychology, 18, 11-23.

McLauren, W.A., Jenkins, J.F., Farrar, W.E.& Rumore, N.C. (1973) 'Correlations of IQs on verbal and nonverbal tests of intelligence', Psychological Reports, 33, 821-822.

Poole, C. and Stanley, G. (1972)'A factorial and predictive study of spatial abilities', Australian Journal of Psychology, 24, 3, 317-320.

Raven J.C. (1975) Manual for Raven's Advanced Progressive Matrices. London: HK Lewis and Co Ltd.

Raven J. (1985) Typescript of currently published new APM Manual.

Schultz, N.R.Kaye, D.B. & Hoyer, W.J.(1980)'Intelligence and spontaneous flexibility in adulthood and old age', Intelligence, 4, 219-231.

Siu,P.K. & So, Annie (1980) 'An intellectual comparison between middle class and lower class', CUHK Education Journal, 8, 1, 15-37.

Siu,P.K. (1983)'Educational theory and design', CUHK Education Journal, 11, 1, 22-26.

Thorndike E.L. (1924) 'Mental discipline in high school studies', Journal of Educational Psychology, 15, 1 and 83.

Van Dam, F. (1982)'Advanced Progressive Matrices and the prediction of academic success', Paper to 20th I.A.A.P. Congress, Edinburgh.

Venables, Ethel C. (1960) 'Placement problems among engineering apprentices in part-time technical college course Part I, Range of ability', British Journal of Educational Psychology, 30, 237-243.

Venables, Ethell C. (1961) 'Changes in intelligence test score of engineering apprentices between first & third of attendance at College', British Journal of Educational Psychology, 31, 56-58.

Venables, Ethel C. (1961)'Placement problem among engineering apprentice in Part-time Technical College course :Part II Level of ability needed for success in National Certificate courses', British Journal of Educational Psychology, 31, 56-58.

Yates, A.J. (1961): 'Item Analysis of Progressive Matrices (1947)', British Journal of Educational Psychology, 31, 152-157.

Yates, A.J. (1963) 'A further study of Progressive Matrices (1947)', British Journal of Educational Psychology, 33, 307-311.

Yates, A.J. (1966) 'The relationship between level and speed on two intelligence tests', British Journal of Educational Psychology, 36, 160-170.

Yates, A.J. (1966) 'Level ,speed and personality factors in the intellectual performance of young children', British Journal of Educational Psychology, 36, 312-316.

Yates, A.J. (1966) 'A Note on Progressive Matrices 1962', Australian Journal of Psychology, 18, 281-283.

Yeas, M & Pascal C.E. (1974) 'Convergent, divergent and esthetic ability and bias in students', Improving Human Performance, 3, 22-37.

Appendix 1--ANSWER SHEET

School Code: _____

Student Code: _____

ANSWER SHEET FOR ADVANCED PROGRESSIVE MATRICES TEST

Personal data

Name: _____ (in English)

Date of birth: _____/_____/_____ Age: _____
Day Month Year

Sex: Male _____ Female _____ (Tick Please)

Science: _____ Arts: _____

Total no. of brothers & sisters (including yourself)
1 _____ (You have no brothers & sisters)
2 _____ 3 _____ 4 or above _____

Parents' occupation: (in Chinese)
Father _____ Mother _____

Appendix 2

Sampling Procedure

5-stage proportionate stratified sampling

Stage 1 : Number of schools which participated in the 1985 HKCEE

School types	Regions			
	Hong Kong	Kowloon	N.T.	Total
Gov't	14 (3.49%)	9 (2.24%)	12 (2.99%)	35 (8.72%)
Aided	65 (16.22%)	115 (28.68%)	79 (19.70%)	259 (64.60%)
Private	28 (6.98%)	63 (15.71%)	16 (3.99%)	107 (26.68%)
Total	107 (26.69%)	187 (46.63%)	107 (26.68%)	401 (100.00%)

Stage 2 : Total number of students who sat in the 1985 HKCEE

School Types	Regions			
	Hong Kong	Kowloon	N.T.	Total
Gov't	2268(3.04%)	1667(2.23%)	1853(2.48%)	5788 (7.76%)
Aided	948(12.72%)	9761(26.49%)	13406(17.97%)	42655 (57.18%)
Private	6428 (8.62%)	17784(23.84)	1939(2.60%)	26151 (35.06%)
Total	18184(24,38%)	39212(52.57%)	17198(23.06%)	74594(100.00%)

Stage 3 : Sample size in 3 types of school

School Types	Regions			
	Hong Kong	Kowloon	N.T.	Total
Gov't	45	33	37	115
Aided	191	389	280	860
Private	127	356	39	522
Total	363	778	356	1497

Stage 4 : Number of sampled classes

School Types	Regions			
	Hong Kong	Kowloon	N.T.	Total
Gov't	2*	2*	2*	6
Aided	6	10*	8	24
Private	4	10	2	16
Total	12	22	12	46

* Not all the subjects in the classes were required, the number of subjects were drawn according to the required number stipulated in previous table.

Stage 3 : Number of sampled schools

School Types	Regions			
	Hong Kong	Kowloon	N.T.	Total
Gov't	1	1	1	3
Aided	3	5	4	12
Private	2	5	1	8
Total	6	11	6	23

Appendix 3

APM Test Instruction

1. Distribute ANSWER SHEET first.
2. Students should use pencil for writing all the answers of the ANSWER SHEET.
3. Explain every item of Personal Data while the students are filling.
   a. For age, make sure it is calculated with years and months.
   b. For parents' occupation:
      Don't just write worker, but what kind of worker.
      Don't just write printing, but what post.
      Unemployed , write U
      Retired, write R
      Passed away, write ' '
4. Distribute Question papers.
5. Set I is a practice test.
   Please ask the students to finish No 1 & 2 at sight. Then tell them the answers . (No 1 is 8 and No 2 is 4)
   After demonstration, please tell the students to complete the questions from No 3 to No 12 of Set I in THREE MINUTES.
6. If the students cannot finish Set I in three minutes, tell them not to worry for it is only a PRACTICE TEST.
7. Start doing Set II which comprises 36 problems from easy to difficult.
8. Then write TIME ALLOWED : X hrs--X Hrs on the blackboard. The time allowed is 40 minutes.

9. Please check that every student has filled out the Personal data while invilgilating.
10. Even though the students have not finished the test in time, please STOP them. NO EXTRA TIME WILL BE GIVEN.

*** PLEASE REMIND THE STUDENTS NOT TO WRITE ANYTHING ON THE QUESTION PAPERS.

Appendix 4

OCCUPATIONAL CLASSIFICATION

(A) Administrative and Clerical Work

01 Professional Administrative/Executive /Manager

101. Directors, managers, or executives in banking, trade, or industry

102. Heads and senior staff in government service, including members of the administrative and executive grades

02 Senior Clerk (or equivalent)

201. Proprietors of small firms, small business

202. Minor supervisory staff in government service (e.g. inspectors, supervisors)

203. Minor supervisory staff in private enterprises (e.g. floor managers and captains of restaurants, bus station

204. Proprietors of small business stalls (e.g. cooked food stalls, miscellaneous goods stalls, etc.)

205. Bookkeepers

206. Secretaries, shorthand typists

03 Junior Clerk (or equivalent)

301. Office clerks, typists, receptionists, telephone operators, office machine operators

302. Cashiers, tellers, shroffs

303. Clerical assistants, shop assistants

04 Messengers

401. Office boys, messengers

(B) Production Work

05 Technologist/Engineer

511. Architects, engineers, surveyors, system analysts, statisticians, technologists, qualified accountants

06 Technician/Craftsman/Skilled Worker

601. Skilled mechanics and electricians, technicians, and technical assistants

602. Craftsmen (e.g. Carpenters, jewelry setters, ivory carvers, precision instrument makers, etc.)

603. Draughtsmen, cartographers

604. Construction foremen, production process inspectors and supervisors (in maintenance, testing, training, etc.)

07 Machine Operator/Semi-skilled worker

701. Factory semi-skilled workers (e.g.assembly line work or work requiring some degree of manoeuvring of machines)

702. Transportation workers (drivers), Drivers and controllers of construction vehicles and heavy machinery

703. Semi-skilled manual workers (e.g. plumbers bricklayers, toolmakers, printing typesetters, bakers, construction scaffold builders,dock workers, etc)

704. Master fishermen, master farmers

08 Unskilled Worker

801. Technician apprentices (e.g. apprentices--especially apprentices--in garages, factories, or in plumbing & electrical work)

802. Factory unskilled labourers (casual labourers)

803. Non-factory unskilled labourers, coolies, unskilled labourers in fisheries and agriculture, etc)

(C) "Service" Work

09 Service Work Requiring Relatively Higher "Professional" qualification

901. Physicians, surgeons, dentists, lawyers

902. University/post-secondary college teaching and research workers

903. Secondary school principals and teachers

904. Professionally trained social workers

905. Clergymen (Protestant & Catholic)

906. Writers and editors of major newspaper and magazines

10 Service Work - Requiring Relatively Lower "Professional" qualification

1001 Primary school teachers and principals

1002 Nurses

1003 Newspaper, radio, and TV reporters

1004 "Peripathetic" salesmen (e.g., insurance, real-estate, office equipment, books) and advertising agents

1005 Movie and TV actors

1006 Professional athletes

1007 Members of non-Christian religious orders (buddhist monks, Taoist priests, etc.)

11 "Personal Service" and Disciplined Service Workers

1101 Barbers, tailors, cooks, tourist guides, bartenders, undertakers, attendants in modern hotels

1102 Salesmen/salesgirls in retail and department stores

1103 Bus conductors, ferry fare collectors, cinema box office clerks

1104 Rank & file policemen and firemen, guards (e.g.Securior)

12 Unskilled Services Workers

1201 Waiters

1202 Amahs

1203 Attendants (e.g. petrol services stations, lift operators, cinemas, public lavatories, bus boys in restaurants, building caretakers)

1204 Hawkers

(D) "Others"

13 Unemployed, retired, passed away, housewife

Appendix 5

APM scores of New Zealand tertiary students (1968)*

Group	N	Age Means	APM Mean Scores	S.D.
Otago University:				
Medical School	85	23.46	24.54	4.33
Dental School	128	22.32	23.05	3.96
Education	60	22.23	23.15	4.12
Physical Education	108	19.62	22.24	4.50
N.Z. School Physiotherapy	100	19.85	22.61	4.05
Dunedin Teachers' College	249	18.57	21.59	4.76
Total	730	20.43	22.55	4.49

* Taken from the typescript of currently published new APM Manual

Appendix 6

Letter to the sampled schools

4, January 1986

Dear Principal,

Research on the norms of HK students aged from 15 to 18 in Raven's Advanced Progressive Matrices Test

I am a Master of Arts in Education student studying in the Chinese University of Hong Kong. At present, I am doing a research on the norms of general intelligence of Hong Kong students aged from 15 to 18. The instrument I use for assessing the students' general intelligence is Raven's Advanced Progressive Matrices test which comprises of 36 spatial reasoning problems. As confirmed by Dr Jimmy Chan of Education Department, APM used by Chinese students of age groups 15 to 18 is first of its kind ever conducted in Hong KOng, the results of which will be helpful and contributive to the educationalists if the assistance and support of the principals can be enlisted.

Since this research is done on a territory-wide basis random sampling has come into play. Your honourable school happens to fall within the sample net, therefore I would be grateful if you can kindly consider the following so as to make this research possible:

a. Time required for the APM test : 40 mins + 10 mins for instructions giving & distribution of question papers

b. Two Classes are required. 1 class Form 4 Science/Arts 1 class Form 5 Science/Arts

c. Preferred months for the test to be held: January or February, 1986 (*In order to include HKCEE students who will be busily preparing the Mock Examination in March, thus preferred months are stated.)

Understanding that my research would certainly bring inconvenience to the students' regular schedule, however, I do wish you will not mind sparing some of your precious time to consider my request.

Looking forward to receiving a favourable reply at your earliest convenience.

Yours faithfully,

_____

(Kitty LI Nim-yu)

Encl: A letter of recommendation
from Dr S.C. CHENG